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**28 August 1984**

# **USSR Report**

**ENERGY**



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28 August 1984

USSR REPORT  
ENERGY

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## OIL AND GAS

### STEPS OUTLINED FOR OIL PRODUCTION INCREASE

Moscow NEFTYANIK in Russian No 5, May 84 pp 2-5

[Article by V. I. Igrevskiy, first deputy minister of the Petroleum Industry:  
"Putting the Decisions of the CPSU Into Practice"]

[Text] Due to the constant and unremitting attention of the CPSU and the Soviet government to the development of science and technology, our country has, in a historically short time, advanced to the leading edge of progress. It has become a mighty industrial power with great scientific and technical potential.

In the 11th Five-Year Plan, as was noted at the 22nd CPSU Congress, the growth of science and technology must be dedicated, to an even greater degree, to solving the economic and social tasks of Soviet society. It must also be dedicated to hastening the transition of the economy to a course of intensive development and to improving the efficiency of public production. Questions of scientific and technical progress were discussed at the November 1982, June 1983, December 1983 and February 1984 CPSU Central Committee Plenums.

A basically new stage in the development of socialist economy has come, in which further successes in socio-economic development depend on the practical use of the achievements of the scientific-technical revolution. These successes are to a greater degree determined by new achievements in science and technology, by the degree to which new scientific and technical discoveries are implemented and by the capability to quickly upgrade equipment and technology.

The USSR's oil industry is one of the highly developed sectors of socialist heavy industry that determine the effectiveness and growth rate of the national economy. In 1974, the USSR exceeded the United States in oil production and at present has a firm hold on first place in the world. The production of oil and gas condensate at the beginning of the 11th Five-Year Plan was 603 million tons.

The rapid growth in oil production during the recent five-year plan was accomplished by bringing new, highly productive fields into production. The overwhelming part of the funds provided by the government for oil industry growth was earmarked for bringing new oil regions into production. At the same time, much work has been done and is being done to intensify oil production; to improve equipment and technology for drilling, gathering and processing casing-head gas; to develop the main pipeline network and etc.

Great successes have been achieved in all these areas, and oil workers have a right to be proud of them.

Today, however, each million-ton increase in oil production requires more effort and greater material, labor and energy expenditures. One reason for this is the change in the structure of recoverable reserves. In recent years, the share of difficult-to-recover reserves has noticeably increased.

An inevitable consequence of this change in reserve structure is the necessity to increase production capacity to compensate for the drop in production at operating fields. This trend determines the scope of work to be done and the capital-, labor-, material- and energy-intensity.

In order to achieve the oil production level specified in the USSR Energy Program by the year 2000, it will be necessary to increase the volume of exploratory and production drilling and increase several-fold the number of operating oil wells.

A significant volume of government funds will be required to accomplish the goals of the program. But any resource--natural, material, financial or labor--no matter how large, is always limited. Therefore, each sector of the economy, including the oil-production sector, has an important and constant task: to effectively use these resources. The main way to accomplish this is to accelerate scientific and technical progress and to widely implement the latest achievements of science and technology.

Many of the problems of the technological growth of the industry have constantly been and are in the center of the Ministry of the Petroleum Industry's attention. These include the accelerated development of new oil fields while holding capital expenditures to a minimum, intensifying production, reducing the number of workers per unit of output by automating production processes and etc.

Good experience has been accumulated in connection with related ministries in accomplishing extensive scientific-technical programs for developing and implementing large-scale measures involving new equipment and technology. Examples of such special-purpose, complex programs are: "Developing and Broadly Applying a Set of Methods and Technical Means for Increasing Formation Oil Recovery to 55-56 Percent and Intensifying the Output of Oil Fields"; "Developing and Implementing Technologies and Technical Means for Drilling Oil and Gas Wells at Rates 2 to 3 Times Greater Than Previously Achieved"; complex sector programs for scientific-methodological exploratory drilling work at the Tengiz Oil Field for 1982-1985; programs for the

collection, preparation and refining of high-sulfur gases from the Tengiz and Zhanazhol fields for 1982-1985; programs for improving repair technology and improving well construction reliability; research programs on oil separation processes at terminals and other programs.

In the course of these programs, new technologies and equipment have been developed. These have been implemented with highly effective results.

Staged terminal flooding has been successfully implemented at Western Kazakhstan oil fields. This technology has greatly increased production from low-production formations containing very viscous oil. At the Uzen'sk Field alone, this has permitted an additional 200,000 tons of oil per year to be produced.

A new technology has been implemented at two sections of the Samotlor Field. It involves two-direction barrier flooding with separation of the oil zone, the gas cap and the sub-gas zone into separate sites. This has noticeably increased production rates and produced about 250,000 additional tons of oil per year.

Much work is being done on using mechanized oil recovery methods. The basic emphasis in this area is placed on implementing the gaslift production method, particularly at West Siberian oil fields. By this means, the time interval between well repairs has been increased by 23 percent. The introduction of submersible centrifugal electric pumps, including corrosion-resistant and heat-resistant pumps, and reliability improvements in them, have increased the time interval between well repairs by 20 percent for wells so equipped.

Mechanized UPT1-50 units have been introduced for underground and capital well repairs. High-capacity complete modular units for oil preparation have been introduced for oil production. The use of these units, as well as pipe furnaces and other equipment, has reduced the output of off-grade oil by 73 percent, while the output of top-grade oil has increased by 15 percent.

Fifty-seven steam generator units, 15 intraformation wet combustion units, 52 water heaters, 15 metering units and 19 gas-injection compressors were put into operation to increase formation oil recovery. The implementation of this and other equipment and improvements in oil-formation recovery technology have made possible the production of an additional 10 million tons of oil.

The technical and economic indicators for drilling production are improving. Drilling speeds and the average annual drilling brigade production have steadily increased. Drill-bit life and well construction speed are increasing.

Drilling organizations have broadly implemented new, productive drilling machines, including the BU-3000 EUK-class machines produced by Uralmashzavod, which were specially developed for Western Siberia, and BU-2500 machines produced by the Volgograd Drilling Equipment Plant. The organizations have



also introduced three-stage cleaning of drilling mud for circulation systems, A7GTSh and A9GTSh low-speed turbodrills, D1-195 helical motors, GNU and GAU drill bits and other high-production equipment. This has reduced well construction time from 51.3 to 48.5 days.

Pipelines have introduced 14 automated process- and production-control systems. Plastobit insulation coating, developed by VNIISPT [All-Union Research Institute for the Construction of Main Pipelines], has been applied very successfully. These and other new developments, including Gnom explosion-proof pumps for pumping oily water, have improved pipeline operational reliability and improved pipeline capital repair quality.

Geophysical equipment and technology are evolving rapidly. This greatly increases the effectiveness of prospecting for oil fields and reservoirs, including salt domes. A multichannel unit is widely used for seismic prospecting. Geophysical data can now be obtained at greater depths. The equipment base and methods for well examination are being improved, particularly by the introduction of digital readouts and data processing. Other innovations are microwall, acoustical, density, neutron and other modern methods of well logging.

Much attention is given to process- and production-control automation. The sector has 35 operating automated oil-production and formation-pressure-maintenance sections. The total number of automated sites has been increased to 274; they produce about 400 million tons of oil per year. Eighty-six computer centers are in operation, as are 157 various automated systems.

In recent years, the use of casing-head gas has greatly improved: the recovery rate of targeted casing-head gas components has reached 95 percent. Gas-refining enterprises have successfully implemented condensate drying processes, intense gas drying for low-temperature refining, K-890 automated centrifugal gas-pumping compressors and other equipment.

Scientific and technical progress, as can be seen from the above, has had and continues to have a marked effect on the oil industry's development rate and is the basis of many of our achievements. But, at the same time, it must be noted that the present level at which scientific and technical progress affects the operating results of enterprises does not satisfy modern requirements for the intensive growth of the economy. This is particularly true in the area of increasing labor productivity.

Plan tasks for implementing new equipment and technology, even those deemed most important, are unevenly fulfilled, with broken deadlines and unfinished work. This is true even when no special provision of resources is needed.

This is particularly true in regard to the fulfillment of plan tasks for increasing formation oil recovery. Thus, in 1983 a number of associations did not fulfill their tasks for high-pressure steam production, high-pressure gas injection or oil production using new methods. While the overall trend for fulfilling drilling targets is positive, tasks were not fulfilled for improving drilling: the plan for increasing the commercial drilling rate was only 94 percent fulfilled.

In a number of cases, the introduction of new equipment was delayed because of late or incomplete shipments or poor manufacturing quality on the part of the supplying ministries. For instance, the Ministry of Chemical and Petroleum Machine Building missed deadlines for developing and supplying hydrogen-sulfide-resistant equipment for the Tengiz and Zhanazhol fields. Deadlines have been missed for the supply and completion of steam generator units for thermal-steam formation treatment and etc.

However, there are many shortcomings within the oil industry itself.

Every year, the sector's research institutes finish about 800 projects. Many of these have until very recently not found any application in production. Only since 1982, when the sector was changed over to a cost-accounting system for organizing the development and implementation of new equipment, has there been a significant turnaround toward the increased use of scientific and technical achievements. Nearly every completed development finds an application.

However, the effectiveness of implementation, primarily measured by its volume, is still low. For instance, VNIISPTneft [All-Union Research Institute for the Construction of Main Petroleum Pipelines] has completed the development of technology and materials for protecting pipelines from corrosion. This development is very important in improving corrosion resistance in the pipeline system. To what degree has it been implemented? After 3 years, only 90 km of pipeline has been done! And there are many similar examples.

Obviously, organizational measures are needed that would clearly and precisely determine the order and responsibility for developing and implementing all innovations, since the sector's growth rate depends on them.

Of no less importance are the technical standards of these innovations. It is the combination of high-quality equipment and technology that can provide all the prerequisites for the highly efficient growth of oil production.

Modern scientific analysis has shown that subjective factors, more so than objective factors, are responsible for the poor rate of scientific and technical progress. The time needed for implementation is increased because the interests of innovation developers and implementers are not coordinated. The extent to which innovations are disseminated leaves something to be desired.

The role of leading institutes in questions of planning scientific and technical development must be especially emphasized. They still do not know the needs of production well enough. They do not involve all of the research institutes and design bureaus of our sector and related sectors in solving the sector's problems. As a result of this, the formation of a number of scientific and technical progress programs nowadays is carried out on paper only. The number of such programs is increasing. Often, the title "special-purpose complex program" is given to developments that are of secondary importance and which are short-term, without any noticeable effect



on the sector's growth. This reduces the timeliness and effectiveness of this work. It is particularly bad in that it reduces the responsibility of science for the growth of the sector.

The USSR Energy Program has placed enormous tasks in front of the oil industry to intensify production. It points oil workers toward all possible means of accelerating scientific and technical progress. The basic tasks for each subsector of our industry in implementing this program for the period up to 1990 are as follows:

#### Prospecting

The drop in the annual average effectiveness of prospecting work must be slowed down. This is in spite of the greater degree to which the initial resource potential of most regions has been investigated, the smaller size of promising structures, the investigation of deeper and more complicated structures and other negative factors.

#### Well Construction

The productivity of drilling units must be increased despite greater drilling volumes and drilling depths, the transfer of drilling to areas further from regional bases and the sharp increase in the number of wells drilled greater than 4,000 meters deep.

#### Oil Production and Oil-Field Development

The interval between well repairs must be increased. On this basis, well-use efficiency must be significantly increased and oil recovery must be increased by introducing new methods.

#### Oil-Well Site Construction

Despite the increase in construction volume, basic changes in location, increased capital-intensity and building for oil fields, the rate of increase in capital expenditures per oil-well site must be slowed down. Labor expenditures must be reduced.

#### Main Pipeline Transport

At present, there have been basic changes in the distribution of new construction and the array of pipe diameters in the transport network. Under these conditions, it is necessary, through scientific and technical progress, to increase the reliability of the oil pipeline system. Labor expenditures must be reduced for pipeline servicing and unit electricity costs for pumping must be reduced.

#### Casing-Head Gas Refining

Resource growth and casing-head gas production have declined in oil producing regions, while production and refining have shifted to new regions. The

percentage of high-sulfur casing-head gases in overall production has increased. Under these conditions, the utilization rate for casing-head gas must be increased and its refining coefficient must be increased.

Planning and organizational methods for the sector's scientific and technical progress must be fundamentally improved in order to achieve these goals. The special role played by the sector's leading institutes in this work must be emphasized. It is namely these institutes that are the most important link between science and production. They must become true scientific-technical centers.

We have accumulated great scientific potential. Collectives of workers, engineers, scientists and production control specialists have been formed. These collectives have great experience in solving many of the most important problems in oil industry growth. This potential need only be effectively utilized.

While on the subject of scientific and technical progress, one must keep in mind, however, that the tasks for increasing equipment or reducing labor expenditures can only be partially fulfilled through new equipment and technology. The rest of the task must be accomplished by improving production organization and control. In other words, oil workers are faced with the task of improving not separate units of equipment and devices, technologies or work methods, not separate organizational improvements for each operation, but improving scientific-technical progress in the sector as a whole.

The acceleration of scientific and technical progress in the oil industry, as in the economy as a whole, is not just a campaign, but a pressing need. Everyone must participate in this--from workers in the ministry's central apparatus, in production associations, enterprises and scientific institutions to each brigade, to each worker. This is the present requirement.

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## OIL AND GAS

### OUTLOOK POOR FOR MAINTAINING WEST SIBERIAN OIL PRODUCTION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 7 Jul 84 p 2

[Article, published under the heading "Meaningful Encounters," by SOTSIALISTICHESKAYA INDUSTRIYA special correspondents Yu. Belanov, V. Kremer, D. Melikov, and Yu. Chaplygin, Baku-Moscow: "Equipment for Oilmen"]

[Text] Until quite recently this seemed to be in the realm of fantasy: a million tons of crude per day from the oilfields of a single region! Precisely this much and, to be more precise, even a bit more is presently being produced in the oilfields of the Tyumen North, this country's main fuel and energy base. But the present situation is such that its further development depends to a decisive degree on the equipment which our machine builders furnish to the oilfield producers. What kind of equipment should this be? This question was discussed at a business conference of oilmen and machine builders. It took place in Baku at the initiative of SOTSIALISTICHESKAYA INDUSTRIYA and the Central Committee of the Azerbaijan Communist Party. Participants included high officials from Minnefteprom [Ministry of Petroleum Industry] and Minkhimmash [Ministry of Chemical and Petroleum Machine Building], officials from USSR Gosplan, workers and specialists from Glavtyumenneftegaz, the Azneft, Soyuzneftmash, and Soyuznefteprommash Associations, scientific research and design organizations.

Meeting participants became acquainted with the operations of the Baku petroleum machine building plants, with promising projects being developed at the AzINmash Institute, and visited the Apsheron oilfields. Later, at a round-table discussion moderated by V. Konovalov, secretary of the Central Committee of the Azerbaijan Communist Party, they discussed mutual complaints, suggestions and variant solutions to problems which have arisen. We publish below a report by our special correspondents on this meaningful get-together.

#### When the Gushers Subsided

At the same time as this get-together was being held in Baku, in Tyumen they were celebrating the 20th anniversary of commencement of commercial exploitation of the Ob oilfields. Twenty years is not that long a time, but it does provide pause for reflection. Such famed fields as the Samotlor, Fedorovskoye, and Mamontovskoye reached their designed production levels. One can assume that the time of the gushers has passed. Of course production

figures on Tyumen crude will continue to rise. But geologists do not promise another Samotlor. Henceforth the crude must be pumped out of the ground.

Like it or not, we should today address the question of a new phase of development of our petroleum industry. A fundamentally different approach and different tactics are needed here. And, of course, new equipment is needed.

Already today there has been a sharp rise in the Glavtyumenneftegaz fields' requirements in beam pumping units, bottom-hole pumps, and well workover equipment. Approximately 40,000 well service and workover operations are performed here each year. In addition, the total number of wells is to be almost tripled over a period of several years.... Citing these figures, Glavtyumenneftegaz's chief engineer, N. Zakharchenko, posed a question point-blank: "Are the machine building people prepared to meet our current and future needs?"

V. Kolomatskiy, head of the Chief Mechanical Engineer Administration of Minnefteprom, reported that the industry's current requirements in basic categories of oilfield equipment are far from being fully met. There is an approximately 15 percent shortfall in availability of beam pumping units and Christmas-tree equipment. There is almost a one fifth shortfall in availability of service and workover-rig equipment. Requirements in downwell equipment and tools are being met by only 30-50 percent....

The quality of oilfield equipment is a matter of particular concern to oilmen. Last year a selective inspection revealed serious manufacturing defects in half of all the UPT-1-50 well workover units inspected. One out of every five inspected production and injection wellheads contained defects. There were complaints about hundreds of sucker-rod pumps....

The fact is that it is no news that users are dissatisfied with oil producing equipment in terms of both quantity and quality. Nor did the oilmen get together with their partners in Baku for the purpose of lodging additional complaints. Incidentally, the machine builders also have complaints: in the Tyumen and other fields there occur many instances of violation of the rules and procedures of operation and maintenance of production and workover equipment.

Mutual complaints were in fact aired, but they were settled quickly, right at the workplace. L. Ovsy, Glavtyumenneftegaz chief mechanical engineer, V. Pashkidov, Yuganskneftegaz well workover shop machine operator, and A. Volkodayev, chief engineer of Nizhnevartovskneft's oilfield transfer administration, working together with designers and process engineers from the Baku plants, "went over" the weakest points of oilfield equipment and reached a mutual understanding: the machine builders promised promptly to correct discovered manufacturing defects, while the Tyumen people promised to be more careful in equipment operation and maintenance. They reached an agreement on a worker and specialist exchange, so that both the manufacturers and oilfield operations people would become better acquainted with each other's working conditions and reach a common objective through joint efforts -- improved efficiency of the equipment they currently have.



## Thresholds of Renovation

We shall state in all frankness that a tour of the plants of the Soyuzneftemash All-Union Production Association did not produce an extremely favorable impression. A good half of their machine tool inventory consists of obsolete and worn-out general-purpose metal-cutting machine tools. A good percentage of their hoist-transfer and press forging equipment is close to a state of breakdown. They are just beginning to install numerically-controlled machine tools and automatic machining lines.

It is true that in recent years they have been touched by scientific and technological advances. Quite modern sections and shops have come on-line at several enterprises. More than 100 type-sizes of new oilfield equipment have gone into production in the current five-year plan, while almost 150 obsolete-design equipment items have been withdrawn from production.

In short, progress has been made. But it is focused a bit strangely: they are placing all their hopes on construction of new buildings and installing modern equipment in them. V. Reznichenko, deputy minister of chemical and petroleum machine building, gave the following evasive answer to the question "Why is it that few new machine tools are being allocated to the Soyuzneftemash plants to replace old ones?": "The ministry itself receives little equipment...."

Evidently USSR Gosplan could also be asked this question. Of course there are priority industries, which receive the newest machining and measuring equipment on a priority basis. But is this generous flow always warranted? Is it not time to examine how it is being utilized in these branches? It is a known fact, for example, that in the automotive industry, in power engineering, heavy and transport machine building, numerically-controlled metal-cutting machine tools are work-loaded barely more than single-shift, and yet requests for new shipments are not becoming fewer and smaller.

The situation developing in the Tyumen oilfields demands, in the opinion of the participants at the gathering, accelerated growth and development of petroleum machine building. And as regards the Soyuzneftemash plants, there should be a greater emphasis on rapid renovation of existing equipment.

"Let's look at things realistically," suggested R. Ismaylov, head of the Soyuzneftemash All-Union Production Association. "Unless a miracle occurs, the 5-year capital investment plan for our association will be accomplished only by half. We are spending on the average less than 8 million rubles per year on expanding production. This is a drop in the bucket if you consider the tasks facing us!"

Year after year the construction people of the republic Ministry of Industrial Construction fail to meet targets on renovation of the association's enterprises. New shops at the Plant imeni Lieutenant Shmidt, imeni G. Petrov, imeni S. M. Kirov, and imeni F. E. Dzerzhinskiy will not come on-line by the end of the five-year plan. Nor will the first phase of renovation at the Plant imeni B. Sardarov be completed. Construction of a new machinery assembly shop at the Kishlinskiy Machinery Plant will not begin....

The general managers of the Baku plants were unanimous in reproaching the construction people for dragging their feet. As deputy minister V. Reznichenko noted, however, if they were pledged to almost triple construction work volume without a contract allocation — and precisely such an increase is necessary in order to accomplish the expansion program at the Soyuzneftemash plants — they would think you were joking.

They people at Minkhimmash see the following solution variant: let the oil people take part on a shares basis in renovation and expansion of petroleum machine building enterprises. And they would not simply provide funds but also share their construction and installation allocation quotas. Incidentally, such interbranch cooperative ventures have occurred. Minnefteprom funds financed the process of bringing new production facilities on-stream at the Baku Plant imeni Dzerzhinskiy, which made it possible substantially to increase the manufacture of bottom-hole pumps and to improve their quality. An even more vivid example is participation by oilmen in bringing into series production at Uralmash a drilling rig for cluster well drilling in Western Siberia. Through joint efforts, the rig was designed, tested and brought into series production at new facilities at record time -- 2 years.

The machine builders also advanced the following argument: in their opinion the oil people overorder equipment and create an artificial shortage. If they become "shareholders," they will be compelled to moderate their appetites and order only as much as they actually need.

V. Sokolov, deputy minister of the petroleum industry, disagreed with this solution variant: "We do not have surplus funds. We are behind schedule in building oilfield lines and facilities in the North and a number of other regions. We cannot and will not give such help to the machine builders...."

V. Kolomatskiy, Minnefteprom's chief mechanical engineer, stated it in even more definite terms: "Why engage in 'handouts'? if Gosplan feels that increased capital spending should be channeled into development and growth of petroleum machine building, it is up to Gosplan to play the cards, as they say...."

Those present at the meeting correctly figured that USSR Gosplan officials V. Orlov and B. Safonov should make a statement on this issue and clarify prospects for the oil people and the machine builders. But they preferred to remain silent.

#### From Prototype to Series Production

Everybody knows that the oilman's job is not easy. But few people know how much precious time is lost in the oilfields and how much crude is not produced due to equipment shortcomings, poor reliability, and inadequate durability. Realities are such that the oil people must develop their own "second" machine building industry. This does not make anybody happy.

"See what happens," states L. Ovsii. "We have established our own large machinery repair and overhaul plants, at which we not only overhaul oilfield



equipment but also beef up commercially manufactured components. And we employ the most modern methods, including plasma metal coating. Should oilmen be engaged in this work? Is it right when a finished piece of machinery is hauled to Siberia across the entire country, and then its parts and assemblies must be additionally reworked at the destination? How long is this going to go on?"

Not long, assured Deputy Minister V. Reznichenko, and told about a completed certification of the technological level at oilfield equipment plants: "We now know what must be done at each enterprise to improve quality. Customers will soon note changes for the better...."

This is a thing of the future, but oilfield workers need today not simply good-quality but fundamentally new equipment capable of an extended service life, operating reliably and, most important, not requiring additional personnel for servicing and maintenance.

Such equipment exists; it will soon be available. Revolutionary changes are promised, for example, by rodless diaphragm pumps designed by a Minkhimmash special design office. Results of field testing of the new pump by Azneft' have exceeded the greatest expectations: well operation between servicing has increased from 30-40 to 200 days or more.

The Siberians, whom the plant people briefed with these figures, were extremely anxious to get their hands on this wonder pump: "Just what the doctor ordered! When will it go into regular production?" R. Ismaylov, head of Soyuzneftemash, replied that it is scheduled to go into production in 1986 at the Baku Plant imeni B. Sardarov. It won't be long now. But the road leading to the new pump has been much too long.

The first version of the diaphragm pump was tested and recommended for regular production back in 1970. In 1980 there was a second attempt to start up production on an upgraded pump design. Things did not really get moving until the third try.

O. Efendiyev, chief engineer at the Baku Neftemash Special Design Office, is of the opinion that the bringing of promising new equipment into production is impeded most frequently by interministerial foulups and numerous rounds of arguments and reconciliation: "The first executing entity is the designer and developer, but he has no authority whatsoever! What we need is a coordinating center which could promptly determine matters pertaining to interaction between branches...."

We shall not discuss the question of whether such a center is necessary or not, although at the gathering they repeatedly returned to this question. Let us examine relations between the principal partners -- the customers and manufacturers of new oilfield equipment. Unfortunately relations leave much to be desired. And evidently the partners are left entirely to their own devices.

In the opinion of the director of the AzINmash Institute, E. Ibragimov, the oil industry people frequently delay testing experimental models. If a new

piece of equipment is obviously superior and if a design is fundamentally practicable, why delay putting it into production? Manufacture should commence at the earliest possible date, with any deficiencies which crop up corrected as they are discovered.

The oilfield people retorted to this approach: "Are you saying we should accept raw, unperfected equipment?!" But the Baku scientists persistently brought forth additional new arguments: "Refining an experimental model takes a great deal of time. And later unanticipated defects will still crop up in the course of operation. Consider the fact that until the testing report is signed, subcontractors will not lift a finger to supply component parts. You yourselves gave approval to series manufacture of a cluster drilling rig without waiting for testing to be completed. You took a chance and received the equipment in an unprecedentedly short time...."

Ultimately they reached an agreement calling for manufacture of a test batch of a new well workover unit which is still being tested. A bold decision! Hasty acceptance is not the best way to establish crucial working collaboration, especially in such a sophisticated domain as science and technology.

The main conclusion reached at the gathering is quite simple on the surface: "Let's work together!" Obviously there could be no other conclusion. Narrow ministerial and localistic approaches, regardless of their source -- the ministries, Gosplan departments or regions -- is too narrow and winding a path. Rapid and efficient accomplishment of such a very important economic task as securing a high, stable level of crude oil production not only today but tomorrow and the day after as well cannot be accomplished by such a path. One becomes convinced from the practical get-together in Baku that what is needed today as never before is a broad and clear-cut program of balanced development of petroleum machine building and the petroleum industry.

3024

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## OIL AND GAS

### MORE ON TYUMEN REGION PROBLEMS, FLAGGING PRODUCTIVITY

Moscow SOVETSKAYA ROSSIYA in Russian 26 Jun 84 p 1

[Article by I. Ognev, Special Correspondent for Tyumen Oblast: "What Kinds of Machines Does the Field Need?"]

[Text] It has been reported from Surgut that the collective of the Second Administration of Drilling Operations has reached a record rate of sinking wells--100,000 meters per year per brigade. This is a result which has never yet been achieved in the entire history of development of the country's fields. We note an important detail: the drillers fulfilled their pledge, initially planned for the end of the 11th Five-Year Plan. This is one bright episode. But this is far from the only one in the daily work of the Tyumen oil workers. Tens of other collectives, through whose efforts a cherished position has already been taken--1 million tons of Tyumen oil per day--provide many examples of shock labor. We are giving the proper persistence, skills and craftsmanship to the oil workers. At the same time, pride in the success of individual administrations forces even greater attention to be devoted to the resulting problems.

During the past 2 years, the oil workers of Western Siberia have not been coping with the planned tasks and are in debt for several million tons of product to the state. Two thousand wells above the norm are idle and their number continues to increase. Specialists estimate that an additional minimum 200 brigades should be added to the existing 350 routine and major repair brigades, otherwise they will be unable to cope with the tasks. But what sense is there in increasing the number of brigades if the repairmen are now idle due to a shortage of hoists, compressors, mobile units and other special equipment?

The oil workers at Surgut and Nizhnevartovsk have provided themselves with their own production buildings. The chief engineer of the Central Equipment Rolling Base No. 1 G. Mukhamadeyev notes that the oil field workers have recently made no complaints against the quality of the electrical centrifugal pumps. This fact merits attention. These units are lowered into the well to a depth of 1.5 kilometers. The slightest malfunction and the entire casing string must be raised to the surface, the mechanism must be repaired and it must again be lowered under the ground. The entire occupation requires a tremendous amount of time. And time in the fields means tons and tons of the most valuable raw

material. However, an increase of the reliability of the pumps is a service of the entire rolling base rather than to the machine builders. It is the rolling base that tries to control rejection. "The oil workers do not trust plant warranties," says Mukhamadeyev. "Therefore, we check and modify the mechanisms and only then do we release them to the fields. And this is with the warranty of our OTK [department of technical control]."

The oil producers have a reason for not trusting the plants. Almost half the products of the Moscow Plant Borets, one-third of the products of the Production Association Livgidromash and of the Lebedyan Plant are delivered to Siberia as rejects. Most of the hoists made at the Baku Plant imeni Leytenant Shmidt are unsuitable for operation. Special bases that are not inferior to the plants in their size have been created for rechecking and repair. However, even they are sometimes unable to cope with the flood of unforeseen work. Over a period of 3 years, fines of the suppliers of low-quality products more than tripled and reached 5 million rubles. It is difficult to determine the total loss which one must calculate for the missed tons of oil. Just one item: more than 1,000 persons are involved in correcting the rejects of the machine builders in the Tyumen area alone. Since there is more and more of poor equipment and since it fails more frequently, the number of repairmen, in the opinion of economists, will double in the near future. Entire collectives must be diverted from their business and must be transformed to some continuation of the machine-building conveyor.

Frequently, in criticizing the equipment, the drillers and oil field workers add that there is even extremely little of such unreliable equipment. The role of mechanization and automation has increased many fold in the current stage of development of the Tyumen fields. Calculations of the Laboratory of Technical and Economic Research of Giprotymenneftegaz [not further identified] predict that this trend will be maintained: expenditures for equipment should be increased during the 12th Five-Year Plan. And the managers, knowing that hopes are few for new machines, are ensuring themselves: where they can get along with one person, they place two. Analysis of the preliminary developments of the program for development of the oil and gas complex of Western Siberia up to the year 2000 shows that all the interested sectors are oriented toward extensive development. The fraction of progressive technologies is extremely small as before. It turns out that while the wells are gushers, the number of workers increased in proportion to the volumes of oil and gas production, but the volume is not increasing in a geometric progression. This is occurring with the present problems of labor resources!

The engineering problems here are related directly to social problems. Here is one of them. The oil workers are manifesting fewer and fewer desires to have anything to do with equipment that has not been adapted to the severe conditions of the Arctic. The personnel of drilling rigs sometimes have no place to take refuge from the snow, rain and winds. The labor productivity of the drillers is one-half as much in winter and 40 percent of labor expenditures goes to control nature. The losses are even higher in the underground and major repair brigades. Nevertheless, people could cope with the units if they were in a warm, equipped building. And there are no technical obstacles to solving this problem at all.



The level of integrated mechanization in the Tyumen fields has not yet risen above 60 percent. This is how the situation appears as a whole. Of course, it was not established within 1 year and has its own prehistory. Production of the basic types of currently operating equipment began 30-40 years ago when the debate was underway whether there was Tyumen oil or not. All the NII [scientific research institute] and KB [design office] were located in the south and center of the country and were unaccustomed to designing their products for Arctic conditions. And even now they are in no hurry to readjust. The Tyumen Branch of VNIIneftemash [All-Union Scientific Research and Planning and Design Institute for Petroleum Machine Building] could be forced to work more vigorously where there are designs of new machines in the Arctic version. But the branch has a weak experimental production base: the Ministry of Chemical and Petroleum Machine Building has been unable for many years to develop its only scientific research subdivision in the Arctic on an integrated basis. New field equipment is also being developed for specific programs of the State Committee for Science and Technology with a lag behind the control deadlines. Specialists of Minkhimmash [Ministry of Chemical Machine Building] and of Minnefteprom [Ministry of the Petroleum Industry] assume that things are going slowly due to the insufficiently firm position of GKNT [State Committee for Science and Technology] on this question, which has turned over its functions of coordinator to the head ministries. But those ministries have neither the right nor means to affect related sectors. Should they do it themselves? But the enterprises of Minkhimmash are producing at 97-99 percent. The remaining reserves are hardly capable of changing the situation.

Let us take a closer look at the same Moscow Plant Borets, which the oil workers number among the main suppliers of low-quality products. The enterprise is densely surrounded by urban quarters and is unable to expand. Reconstruction of it has been postponed for 8 years. The machine tools in the shops stand almost against each other. In visiting here, I was involuntarily reminded of the enormous buildings at Surgut and Nizhnevartovsk, where the rejects of the machine builders are collected. It became clear that the current technical and economic and social problems of Borets are to a known degree the result of misalignments in the established practice of distribution of capital investments.

The traditional method was that the funds are allocated according to principle: the producing sectors are first and the machine building sector receives what is left. There is no quarrel in this, the country is experiencing a great need for raw materials. But the machine builders are not separated from this matter. They have been called upon to develop new high-performance equipment and production systems that are capable of saving the labor of hundreds of thousands of people, especially expensive under Arctic conditions. As scientists note, extensive development of these sectors are still under way--the users are the technicians due to the use of newer and newer resources, including labor resources, rather than intensification of production based on the latest engineering systems. This conclusion can be completely related to the Western Siberian Oil and Gas Complex, where only 0.2 percent of the total expenditures was directed to machine building since 1971.

One solution suggests itself. Funds must be redistributed among the producers of equipment and its users. The output of equipment must be increased and its

quality must be raised in the large buildings similar to those that have been erected in the Central Priob'ye, rather than being involved with modification of semifinished products. One can cite as many arguments as possible in favor of this reorientation. For example, a large number of pipelines regularly requires repair at the Samotlor oil fields. The pipes are unable to tolerate the interaction with aggressive water and fail within a year. But the same pipes, but with special coating, are 10 times as expensive. A plant has already been designed and constructed for this purpose. One would think that the machine builders were concerned about it? No. The oil workers developed it through their own efforts. But much more labor and funds were expended than would have been necessary under specialized production conditions. Would it not be better if each were involved with his own direct affairs?

The equipment users have not always had sufficient interested attitude toward development of machine building. They have not decided: order the equipment from Soviet enterprises or purchase it abroad. The selection in favor of imports is sometimes unsubstantiated. I was told at the VPO [All-Union Production Association] Soyuzkompresormash that several times more foreign currency rubles is expended annually on purchase of some types of compressors and large centrifugal pumps than is required to support production with the necessary number of these units through production at Soviet plants. The machine builders are justified in assuming that they are the ones responsible for meeting the needs of the national economy for their own products and they are the ones who decide the method in which this is done, based on the capabilities and interests of the national economy.

Specialists see many levers which can be used and should be used to achieve a fundamental change in the machine building sectors operating for the oil workers. And the sooner this change begins, the more successful the problems of development of the country's fuel and energy base will be solved.

6521

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## COAL

### DONBASS MINES' USE OF SEVEN-DAY WEEKS DISCUSSED

Moscow PRAVDA in Russian 23 Mar 84 p 2

[Article by V. Kuz'mishchev and S. Prokopchuk, correspondents: "A Rock at the Crossroads"]

[Text] The most difficult thing is to take the first step. This is all the more true if one must decide which path to take. However, it is only in fairy tales that a rock with a prophecy of the future suddenly appears at a crossroads and the dumbfounded rider then learns what is to be found or lost on the path taken.

In life everything is more complicated, but the alternatives are similar. There is always an easy path and a difficult road with many surprises. In the first case, success is, as a rule, fragile. In the second, people become the masters of the situation and dictate conditions.

About 10 years ago when, because of more complex mining geological conditions, it became more difficult to extract coal in the Donbass at the previous record rates, the USSR Minugleprom [Ministry of the Coal Industry] found itself at a fork in the roads. There was a choice: rearrange work organization and create machines for working in the new, thin seam conditions, or gather some more people and working days. Obviously, it chose the first. In our time it is improper to even mention the second, and, for the time being it is not mentioned.

There were bold designs for contemporary equipment, and even equipment of the future. Although USSR Minugleprom has an entire branch for coal machinery building, the path from design to prototype and then to series production was somewhat longer than the branch staff had supposed. PRAVDA has repeatedly written about why this is happening. This article is about the other alternative.

Starting in 1970 the sector began to move along the second path: more and more Sundays became workdays for Donbass miners. Here is the perplexing growth: In 1970 coal was extracted on 9 Sundays, in 1975 on 13, in 1980 - 40, and in 1983 54, actually every Sunday. While about 10 years ago there were telegram requests to work on some days off, by 1978 some of the Sundays were simply planned as workdays.

What is happening? Is it true that no modern equipment has arrived at the mines for almost 15 years? Why the demand for constant storming? Yes, the problems in the coal industry are still bigger than the achievements. Nevertheless, every year miners are receiving more highly productive equipment. Last year 85 percent of equipment was mechanized supports, narrow web combines and cutter units, the most progressive contemporary equipment for coal extraction. Perhaps it is necessary to go down into the mines on Sundays because there are not enough people? The number of miners is constantly growing and now exceeds the planned figure by 10,000.

This means there are people and machines for work. Then why is Donbass coal extraction declining and why must lost time be made up on days off? Such a question might be posed by a dilettante, for specialists have long ago ascertained just why extraction is falling and why it is necessary to work on days off. What we assume to be a consequence is in fact the cause of many of many disorders. Not the main, but one of the basic causes.

Let us analyze why the cure became the cause of the disease. Initially the rare working Sundays increased output noticeably. The effect was attained without any kind of efforts or investments, if one does not count some internal struggles with conscience as to why one had to act in opposition to KZOT [Labor Laws]. Later, as extraction increased on Sundays, it started falling on weekdays. The number of Sundays worked has now increased 3.5 fold compared to 1975, while the average monthly number of days off has not increased. True, 12 - 14 workdays above the plan can be added to the balance, but, as the inexorable statistics show, the workers will make up for the remaining 40 by compensatory time and absenteeism.

How did all this actually occur? The mine economies have dropped from the sky to the earth and even below it. Work on Sundays requires the distribution of staff among seven, rather than six workdays. As a result, over a year each day 2,500 workers fewer have showed up for work at 250 faces. Section chiefs and brigade leaders often don't even know who will be on the shift today. The schedule shows that Ivanov decided to take off for last Sunday, while Petrov had to go to his mother-in-law's for a name day and decided to take a day off in advance in exchange for his next day off. Sidorov simply found urgent things to do in his garden. What is he to do, if they always implore him to work on his regular day off? What right has the manager to do this, when he himself so readily violates the law, making Sundays workdays. This makes the collective unmanageable.

This is taking place at the majority of mines in the Donbass. Even at those which meet the plan during workdays, which have excellently organized work, and their equipment is operating at the highest productivity. The Krasnogvardeyskaya Mine in the Makeyevugol' Association and the Mine imeni M. Gorky in the Donetskugol' Association are examples of this. Why? First of all, the order concerns everyone, secondly, it is necessary to make up for shortfalls of neighboring units, thirdly, frontrunners should not obtain less than the laggards. Even though it contradicts common sense, wages are higher at mines where things are in disorder, and the low extraction levels made up by Sunday work. Double time is paid for these days. Last year alone, overtime payments totalled 120 million rubles. Even without this, Donetsk coal production costs are high enough.

So are they getting something for their money? It is, after all, no accident that Sundays are called "days of increased coal extraction". Again, however, statistics are evidence of the opposite. Data from the Donetsk Scientific Research Institute for coal show that output on Sundays is considerably lower than on workdays. Moreover, this gap is growing yearly. In 1975 14 percent less coal was extracted on Sundays than on workdays, and in 1983, 24 percent less. It should be kept in mind that during this same time average daily extraction declined by 18 percent.

This last figure is the very unmanageability giving rise to the semilegal practice of a seven-day week.

Don't these words sound strange when applied to mines? As you know, this is in no way due to the nature of the technology, as is true for chemical and metallurgical workers. It involves other figures which are of little consolation. Since the introduction of the seven-day week absenteeism has quadrupled and is growing yearly. True, the number of workers dismissed for absenteeism is also growing, it has doubled. However, the strengthening of discipline requires an objective basis -- the clear and strict observation of mine working conditions and shift schedules. As they are now compiled there are officially no working Sundays. The miners have 306 workdays, not 350. Nevertheless, the schedule has to be set aside when, on Thursday or Friday, comes the obligatory telegram from USSR Minugleprom: "Due to production necessity, consider Sunday a workday". Many mine directors with whom we talked were harried by such indefiniteness, and were not only weary of such endless waiting, but also simply physically tired. After all, while workers can take days off, managers work every day.

There is another very serious problem causing seven-day weeks. Prior to the "experiment" days off were dedicated to the maintenance and repair of equipment, transport, mine workings and shafts. Now there is no such time. Maintenance and repairs are either done in a hurry or left "for later". The repair of a mine shaft, for example, requires 3 to 4 shifts in a row, that is an entire day, something which is not available at the majority of mines.

The lack of time for repairs has increased the number of emergencies and idle time. This means the loss of coal. In 10 years the time loss on mucking operations at UkSSR Minugleprom mines has grown 1.3 fold, while at the 'Makeyevugol' Association, it has doubled. Studies have shown that this is a direct consequence of insufficient care for equipment.

Thus, work on Sundays has only covered losses during the week. However, recently, losses are exceeding Sunday work. According to specialists' studies, because of idle time, compensatory time and breakdowns -- all the consequences of seven-day weeks -- 21 million tons of coal are lost annually. However, we are loosing much more, above all the high conscientiousness and discipline for which Donbass miners have always been famous.

The organizational confusion inherent in storming plays into the hands of mine managers who attempt to cover their blunders with constant "give, give". It is advantageous to them to work carelessly during the week, cover their mistakes with Sunday work and claim six days. This also applies to those workers who put

in time for doubletime under the ground on days off (recall that productivity is much lower on these days), and who skip another day without penalty.

Is there a way out? This was the situation during the 1950's. At that time the Donbass turned away from a seven-day week and converted to the new conditions. Production began to fall, but later increased through higher labor productivity during the week, organization and discipline improved and equipment was better maintained. Other alternatives are possible, as the practical experience of progressive enterprises shows.

For example, there is the "pyatizvenka", 3 workdays and 2 days off, often on a sliding schedule. Several mines in the republic are now working this way. This is essentially the schedule adopted by metallurgical workers. It can be introduced only by those who produce above-plan coal and thanks to this can permit themselves to have about 20 percent more people on the staff. This is a luxury which is still a dream to the majority of collectives.

In the opinion of those we met at working faces and offices, the most rational solution is to decisively reject the seven-day week and convert to one common day off on Sunday. Then let it be completely at the disposal of repair services. It is time to finally make it possible for them to really rebuild mines and equipment and to guarantee their stable operation throughout the week.

Of course, at first it is possible to have a reduction in coal extraction and, in some places, wages. However, this will indisputably be compensated by better organization and higher productivity. Specialists have already figured out how to gradually convert to such conditions so there won't be a sharp drop in output.

About 10 years ago USSR Minugleprom took the path leading to easy but deceptive successes. It has now become clear that this did not increase output growth. This means finding the courage to turn away from this path. The most difficult thing is to take the first step.

11574

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## COAL

### DONETSK MINERS REMEMBER STAKHANOV

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian: 8 May 84 p 1

[Article by I. Chuprynin, director, Torez Mine Administration, V. Timchenko, comprehensive extraction brigade leader, winner, USSR State Prize, V. Ponomarenko, tunnel driver brigade leader, and A. Zakharov, working face worker and section party organization secretary: "Stakhanovite Lessons"]

[Text] On the night of 30 and 31 August 1935, Aleksey Stakhanov, a faceman at the Tsentral'naya-Irmino Mine in Donetsk Oblast, performed a genuine feat, using a pick-hammer he dug out 102 tons of coal.

Even today we admire this outstanding achievement. However, it is not only that one person overfulfilled the norm 14 fold, but also that his example served as the basis to a mass movement for the highest labor productivity.

A special honor has fallen upon us, the miners at the Torez Mine Administration. Aleksey Grigor'yevich Stakhanov worked in our collective for many years. Thus, we have participated in the Stakhanovite tradition directly from hand to hand, if one can so put it. Continuing this remarkable and innovative tradition, we have decided to fulfill the five-year plan for coal extraction four months ahead of time, by the 50th Anniversary of the Stakhanovite movement, which will be widely noted in August 1985.

We happily learned that the Politburo of the CPSU Central Committee has approved the initiative of labor collectives in the coal, metallurgical and other sectors of the national economy who are spreading competition to fulfill the five-year plan targets for a number of very important indicators by this famous date.

We are well aware that it will not be easy to meet the obligations assumed. In order to better understand the difficulty, take this figure: 505,000 tons is this year's plan target for two mines. We must now surpass this taut target by almost 10 percent or we will not reach the high goal.

Obviously, we are not coming with empty hands to the jubilee of the Stakhanovite movement. There is a fairly good reserve for preceding years of the five-year plan -- 105,000 tons of above-plan coal. Almost 30,000 tons of additional coal extracted since the start of this year can be added to this. The weight of these

above-plan tons gives us confidence for tomorrow. Our main trump cards -- experience, innovative searches and Stakhanov science -- will not fail in face of difficulties.

Although it is difficult to believe, it is a fact that not too long ago republic Minugleprom seriously discussed the closing of our mines. There was a solid basis to this: we had mined the main reserves and come right to the edges of the mine field. Everything seemed simple and clear -- no coal meant no mines. Continuing this line of thought meant no collective and its traditions acquired over long years. We, of course, could not settle for this alternative.

Specialists at the Torez Anthracite Association proposed a bold solution: take the so called balance reserves (that is simply low-quality [brosovyye]), where thin seams of coal lie in masses of rock. Naturally, such strata are no gift. There are complex mining geological conditions, high ash content and large concentrations of gas. However, there was no other way out: either overcome these barriers or close the mine. We chose the former.

We did not immediately succeed in finding the key to these reserves. The equipment which we had used in the mines up to then could not withstand the loads and broke down. The hard rock was clearly too much for the teeth of low powered combines. Soon it became clear to everyone that modern mechanized complexes were needed.

"And where will these complexes themselves be built?" asked Stakhanov.

"At the Druzhkovka machine building plant."

"So why talk about it. That's right near by, let's go!"

Here also, Aleksey Grigor'yevich gave us a good lesson in decisiveness and resourcefulness. We visited the plant and held a meeting. Stakhanov gave a speech, calling upon machine builders to help the miners in equipping working faces. A decision was made right there. The Komsomol members at Druzhkovka undertook the manufacture of three KM-87 complexes in their free time.

The use of mechanized complexes and IGSh-68 combines permitted us to be the first in the association to reach daily extraction levels of 1,000 and more tons per longwall. This was a great success. However, to assure stable work, day after day, month after month, in such conditions, the miners need a solid basis of previously prepared work fronts.

By accelerating the rate of tunnel driving we got what is sort of a double reserve of strength. For each operating longwall there is a fully equipped one in reserve.

Perhaps to some people this seems like an excessive luxury. Not at all. Experience has shown that when we are working with reserves, as we say "with a whisk broom", a double reserve is not a luxury, but a production necessity. For example, it takes a brigade to enter into a geologically disturbed zone. An hour of idle time at the present technical levels means a shortfall of about 100 tons of coal. A "hot" reserve has permitted us to eliminate such losses and to effectively use work time.



One should not think that everything was so easy. It required a general reexamination of the traditional scheme for mining operations. For example, today we know that in July we will finish the 19th longwall and move to the 20th, which was a reserve. It would seem that there are no problems. However, the 20th longwall has already become the main one. We should have prepared a new reserve by this time. The preparation of reserves should always be two steps ahead of extraction.

Strictly speaking, we did not make any discovery, but only followed a well known Stakhanovite principle: new equipment requires new production organization.

Prior to the introduction of narrow web combines we had 7 extraction sections, now we have 2. The number of people extracting coal has declined by almost one-half, while fuel output has grown. The same applies to tunnel driving: instead of 5 tunnel driving brigades, 3 consolidated ones have been set up. They complete considerably more work.

Assuming socialist obligations in honor of the jubilee of the Stakhanovite movement, we have taken into consideration not only the potentials of technical progress, but also reserves such as the collective's skills and militance. Of course, there is the powerful force of competition.

Tenacious competition for the A. G. Stakhanov Prize spread between mucking and tunnel driving brigades and shifts. It was decided to sum up its results every 10 days. This gave rise to the slogan for labor rivalry "Fifty high pressure ten days for the 50th Anniversary of Stakhanov's record."

The first leaders have already appeared: Mikhail Ivanovich Yershov's extraction brigade and Vasiliy Khabirovich Valeev's tunnel driver brigade. However, the main heat of the struggle is still ahead. The competition's final results will be tallied in August 1985. Then we will see who wins the right to permanently keep the prize.

A change of miners' generations is now taking place. Veterans of the miners' profession Grigoriy Markovich Pedik, Boris Il'ich Lysenko, Petr Sergeyevich Ponomarenko and others with responsible posts have been replaced by Valeriy Perov, Vladimir Vodop'yanov, Mikhail Kapshuk and Aleksandr Kazachek. It should be said that in general the young miners are living up to our hopes: they are conducting work skillfully and enthusiastically.

The veterans (great thanks to them) have not yet "laid down their weapons". Having applied for their rightful pensions, practically all of them continue to work at the enterprise, handing on their skills and experience to young workers. For example, we recently had a ceremony for the retirement of Petr Vasil'yevich Yartu, Andrey Antonovich Vasin and Grigoriy Sidorovich Goncharuk. What happened? Before a month had passed they came to the director's office saying: "We can't live without the mine!"

Thus, the Stakhanovite baton is passing from the older to the younger generation without a slip.

We were deeply touched by the warm and sincerely respectful words of CPSU General Secretary and Chairman of Presidium of the USSR Supreme Soviet K. U. Chernenko concerning key workers at a meeting with workers of the Serp i Molot Metallurgical Plant in Moscow. Veterans are not only the backbone of a production but are also really the pride of our working class. We value them and rely on their experience.

Of course, not everything is going as we would like. There are difficulties, and considerable ones at that. Due to various equipment breakdowns, in the First Quarter extraction brigades lost 11,460 minutes of work time. Although this is only half of last year's losses for this reason, we are not completely satisfied. Calculated in terms of coal this means we failed to deliver consumers almost 8,000 tons.

Undoubtedly we have many shortcomings here. However, one must note that mechanized complexes valued at hundreds of thousands of rubles are now left in the mines without reliable technical servicing. According to existing rules, once every six months adjustments and current repairs should be performed by the specialized installation administration of the Torez Anthracite Association. Incidentally, we signed the appropriate contract with them. In actuality, our complexes have been working at longwalls for a year or more without repairs. There is one reason: no spare parts.

Obviously, it is time for republic Minugleprom to earnestly set about solving this acute problem.

In spite of all the difficulties, our complex can and should work better. The initiative of the Torez miners is directed towards this. We are turning to the country's miners with a call to follow our example and expand effective competition to worthily celebrate this noted jubilee. From this point on let our common slogan be: "The five-year plan by the 50th Anniversary of the Stakhanovite movement!" We will show with deeds that the labor feat baton of heroes in the first five-year plans is in our reliable hands.

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## COAL

### ENGINEERING ASSISTANCE IMPROVES KUZBASS MINES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 15 May 84 p 2

[Article by Yu. Malyshev, technical director, Yuzhkuzbassugol' [South Kuzbass Coal] Association, candidate of technical sciences: "Engineering Support"]

[Text] Collectives of enterprises in the Yuzhkuzbassugol' Association are working well this year. Since the first of the year they have hoisted up more than 500,000 tons of above-plan fuel. They have laid a solid foundation for the unconditional fulfillment of socialist obligations: ensuring a 1 percent above-plan increase in labor productivity and an additional .5 percent reduction in production costs. It is not without basis that we reckon that a thorough improvement in engineering support to brigades can help achieve this.

Above all, we have used such help in the development and introduction of new, more progressive technological solutions such as, for example, the pillar free stoping of coal. Until recently it was an innovation, and approached cautiously. The basis for this was that mucking brigades did not have reliable and convenient methods of roof support. Because of this it was difficult to retain conveyor galleries for repeated use as airways.

We have been helped here by specialists at the Kuznetsk Scientific Research Institute for Coal, who have created a new support, the so-called yielding support. We organized its manufacture at centralized electromechanical shops in the city of Osinniki and in time completely met the association's needs for them.

Pillar free stoping has now been introduced at all mines where mining geological conditions permit its use. As a result we have attained more than a one-third reduction in opening and preparatory workings. Pillar robbing has given mines an additional 8-10 percent more coal which the old techniques left underground. Thus, with the same labor intensiveness, our brigades have become far more efficient.

Almost two decades ago A. Burchakov, professor at the Moscow Mining Institute and doctor of technical sciences published an article on the organization of mining operations at the mine of the future. We were attracted by his suggestions about the more rational layout of coal mine fields. Initially the Zyryanovskaya Mine and later the remaining enterprises in the association undertook the implementation of his ideas. Now, because of the optimization of planning decisions for mucking brigades it requires far fewer movements from face to face to extract the same quantity of coal. Every movement is a considerable loss of time.

This same goal is served by another innovation now being introduced at Yuzhkuzbassugol'. With the participation of Professor A. Burchakov and other specialists, a technology for turning mechanized complexes has been developed. It is hard to overestimate the significance of this maneuver because a modern coal extraction unit, consisting of a multitude of large components, requires considerable time and effort for disassembly. It is a labor intensive job to take it apart, move it through narrow tunnels to another longwall and put it together again!

Fairly often, after working 2 - 3 months, a brigade is forced to move to a new face. This means disassembly and assembly work taking more than a month. We therefore seized upon the possibility of turning around complexes so as to continue extraction from already prepared mechanized longwalls. The first in the association to use such a maneuver were miners in the brigade of V. Bardyshev, an experienced machinery operator at the Novokuznetskaya Mine and a Hero of Socialist Labor. Servicing a average capacity complex, this collective has produced up to 1,000 tons of coal daily during turning. The well known brigade led by P. Frolov at the Raspadskaya Mine has followed Bardyshev's brigade.

It faced a task of a higher order. First of all, the collective decided to extract 1 million tons of coal annually and was working under these conditions. Secondly, the seam here was thicker, the longwall longer and the appropriate complex, a 2UKP, installed in it. The brigade was the first to use a laser equipped alignment device for turnarounds. Rock pressure gauges were installed in the head section of the longwall. We obtained information here which helped designers strengthen the carrying capacity of the main part of the mechanized complex.

This year we plan another eight turnarounds. This is a very beneficial operation. P. Frolov's brigade, completing a difficult maneuver, turned the complex around 180 degrees, and was able to extract 80,000 tons of coal in a month. That is, it continued to work at 1 million ton annual extraction rate and met its socialist obligations. The main thing is that it practically did not loose a single day in the movement from face to face.

In recent years specialists in comprehensive mechanization have been totally involved in preparatory work and mine transport. Today the largest share of heavy manual labor is in tunnel driving, the head of the technological chain. The final work results of a mine's entire collective depends on it. In order to expand this bottleneck we are widely introducing lightweight metal roof covers which can be removed and used again and netting tie downs with fiberglass filling. This has substantially lessened tunnel drivers' work and saved on metal and timber.

Last year the association had 46 brigades which extracted 1,000 tons of coal each. Thirteen of them reached 500,000 tons annually and 2 exceed 1 million tons. Thanks to them the association met its socialist obligations for all basic techno-economic indicators. Above-plan production was 700,000 tons and extraction levels were the highest in the association's history.



To produce 28 million tons of coal and assure the rhythmic operation of mucking brigades it was necessary to considerably increase the potentials of transportation. Specialists also solved this problem by building storage bunkers at the junction between conveyors and loading points. During the time empties are being delivered, a mucking brigade now continues to work normally, the extracted fuel going into the bunker. If a face is idle, coal accumulated in the bunker is unloaded. This means rhythmic operation for mucking brigades and transport equipment.

Specialists showed us the advisability of driving wings. We organized direct ventilation through them and were able to "multiply", in time and space, the delivery of equipment and materials for tunnel driving and installation. This alone cut in half the time needed to deliver roof support sections for a new longwall.

Finally, engineering services developed and introduced a successful way of supplying brigades with units and machinery such as drive heads for scraper conveyors, belt conveyors, drills, winches and other items. Magazines, as we call them, were set up. Enterprises receive everything they need through them, under the mandatory condition that in exchange for a new or repaired item they give an old broken down one. We have thus concentrated spare parts and organized centralized repairs.

The scale of this work can be judged from an example. Last year more than 400 scraper conveyors were rebuilt. This is almost as much as the association obtains from investment funds. Quite recently we always heard constant complaints: "No fasteners, give us drills!" This problem has now been completely eliminated. There have been considerable improvements in the supply of electric drills to brigades.

The work experiences of our engineering services show that a production association can do very much on its own, based on modern science and technology.

This is in complete accordance with the spirit of the decisions of the December (1983) and February and April (1984) CPSU Central Committee plena.

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## COAL

### PLASTICS USED FOR MINE GROUND SUPPORT

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 23 Jun 84 p 1

[Article by G. Dorofeyev, correspondent, "With the Help of Scientists"]

[Excerpt] The unforeseen happened at the October Mine Administration, Donetsk-ugol' Production Association. They prepared a good longwall, equipped it with a powerful complex, but could not extract the coal, the roof was letting them down. It consists of small sliding blocks of rock reminding one of small cakes of soap (miners called them "soap bars") which "float" behind the combine, leaving cupola formed piles. So, it was decided to request help from UkrNII-plastmass [Ukrainian Scientific Research Institute for Plastics].

Thus began the search for a new technology for coal extraction using chemical methods of ground support. This is an urgent problem to others besides the miners at the October Mine Administration. There is perhaps not a single coal enterprise where mining geological conditions have not hindered miners' work. As miners go deeper, known methods of roof support are more frequently failing. Fundamentally new approaches to the control and support of mine workings are required.

It is obviously not necessary to mention all the difficulties which UkrNII-plastmass specialists encountered in solving this problem.

N. Laznya, a section chief, said, "The injection of a special solution into the wall rock will, as they say, have 100 percent results in stabilizing the "soap bars" and retaining the roof. The experiments opened huge possibilities for using chemicals to support mine workings. Miners are now ready to use the innovation. However, further research and development in this direction is now delayed by the lack of special pump units with precision control over the amount of material injected. In short, the matter now rests with others -- the designers and machine builders working on the creation of these units.

UkrNIIplastmass was set up a quarter of a century ago. Today it is one of the leaders in the chemistry and technology of polymers. Using epoxy resins and hardeners, the scientists' collective has created a broad assortment of glues, bonding agents, mastics, pressed and pellet materials which have found wide use in all sectors of the economy. The institute is engaged in scientific and technical cooperation with more than 30 institutes of the USSR Academy of Sciences, dozens of sectorial institutes and more than 1,000 enterprises which use materials it has developed.

## COAL

### BRIEFS

**AHEAD OF PLAN**--Lutugino, Voroshilovgrad Oblast--M. Bocharov's brigade at the Leninka Mine, Voroshilovgradugol' Association has extracted more than 6,000 tons of above-plan coal since the first of the year. The fast start to this year is a continuation of last year's successful work by the progressive collective, when the brigade doubled the longwall loadings, increasing them up to 800 tons of coal daily. In response to the decisions of the December (1983) CPSU Central Committee Plenum, the brigade is calling for the 1,000 ton daily level this year. The brigade has firm labor discipline, responsibly looks after equipment and has well organized competition. Much attention is given to the repair shift, which is staffed with the most skilled miners. The results of interbrigade competition are summed up daily. The winners are often the links of M. Sinyakin and V. Orlov, combine operator A. Ivashut, working face miners V. Grigor'yev, A. Polyakov and others. [By B. Lizogub] [Text] Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 21 Feb 84 p 1] 11574

**ROSTOV COMPETITION**--Rostov--The collective at the Ayutinskaya Mine, Rostovugol' Association is among the leaders in competition to increase fuel extraction, improve labor productivity and reduce output production costs. Several thousand tons of coal have been hoisted up the mine since the start of the year. Labor productivity has increased by 5 percent, and production costs reduced by 2 percent. The working face brigade headed by I. Golobored'ko has the best indicators. Work is in mining geological conditions which are not easy, however, nobody has shirked before the difficulties. This is helped by comradely cohesion and high professional skills. The brigade has 500 tons of coal on above-plan account and has saved several thousand rubles worth of materials. [By M. Kryukov] [Text] [Moscow PRAVDA in Russian 9 May 84 p 1] 11574

**AHEAD OF SCHEDULE**--Vorkuta (Komi ASSR)--Miners beyond the Arctic Circle have attained high rates of fuel extraction. Completing their 6 month targets ahead of schedule, they have sent the country's center 10 million tons of high quality coking coal since the beginning of the year. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 21 Jun 84 p 1] 11574

**OVER THE TARGET**--Voroshilovgrad Oblast--Since the start of the year miners at the Mine imeni Kosmonavtov, Roven'kiantratsit Production Association have sent consumers 750,000 tons of coal, including 130,000 tons over the target. The greatest contributions to the success were made by the extractors brigades led by Hero of Socialist Labor G. Motsak and V. Sakharov. They have hoisted up 75,000 and 46,000 tons of coal above the plan. The collective is attaining a high level of working face worker labor productivity. It exceeds plan indicators by 13.9 percent. The production cost per ton of coal extracted is 1 ruble below the plan. [By V. Mikhaylichenko] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Jun 84 p 1] 11574

TUNNEL DRIVING SUCCESSES--Rovenki-(Voroshilovgrad Ob'ast)--Since the start of the year, the tunnel driving brigade led by USSR State Prize winner A. Overchenko at the Mine imeni Frunze, Roven'kiantratsit Association has driven 1,200 linear meters of large cross section workings. One out of six meters is above-plan. This means that the progressive brigade is a month ahead of schedule. Average monthly output per tunnel driver exceeds the plan by one-third, and the cost per meter has been reduced by 2.5 percent. This is the best indicator in the Donbass. Notably, the miners are reaching such successes with fewer workers: instead of 79 people there are 63. [By A. Mayboroda] [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 Jun 84 p 1] 11574

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## NUCLEAR POWER

### NEWS FROM ATOMMASH

#### From Laggards to Leaders

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 May 84 p 3

[Text] Consolidate the successes achieved during the pre-May socialist competition--this is what the builders and operators of Volgodonsk have decided. In issue No 20 (280) "SOTSIALISTICHESKAYA INDUSTRIYA at Atomash" the paper publishes material about the course of the "work watch." At Promstroy-1 the brigade headed by the Communist N. Khalizov was constantly in the first ranks of the competitors. Recently, the brigade chief decided to transfer to a collective that was lagging. Now his brigade is among the leaders, daily fulfilling its norms.

The editors initiated on the pages of the paper a roll-call of the cost accounting brigades participating in the construction at Volgodonsk and Atomash with an article by the chief of a combined work team from GRAZHDANSTROY SMU-8 [Construction-installation administration] N. Sadchikov. Continuing the roll-call under the caption "To See the Final Goal," the paper published the talk of the chief of a combined work team of SMU-2, an integrated house-building combine, N. Donchenko.

There are serious shortcomings in the implementation of the economic and social plan of development of Atomash. In the article by V. Navozov, "How the Plan Was Lost," reasons for the situation are analyzed. The author stresses that it is necessary for the administration and the trade union committee to exercise constant control over the fulfillment of the plan.

Disease prevention and prophylaxis occupy an increasingly important place in the work of the Volgodonsk medical staff. Head of the department of functional diagnostics of Hospital No 1 Ye. Arutyunyan writes in her article "Each in Full View" about the successes and problems in this important state matter.

This issue also publishes an article by Z. Bibikova, "Laggards...Leaders," responses to criticism, a topical article by Kuz'ma Volgodonskiy, "The Irony of Fate, or With Little Steam," cultural news, news of everyday life and sports information.

## Work Teams on Contract

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 12 Apr 84 p 2

[Text] Socialist commitments of the collective of the Volgodonskenergostroy Trust and its subcontracting organizations envision for 1984 the broad introduction of the work team contract method at construction-installation operations. What troubles the chiefs of the cost accounting work teams today? What is slowing down the wide-scale dissemination of the contract approach? In order to answer these questions "SOTSIALISTICHESKAYA INDUSTRIYA at Atomash" in issue No 16 (276) began the roll-call of cost accounting work teams, inviting the participation of all who are not indifferent to the future fate of the work team contract at the Volgodonsk construction site. The paper granted the first word in this regard to the chief of a combined work team from N. Sadchikov Grazhdanstroy SMU-8.

The school of Communist labor where the manager of the planning section of the special SMU S. Golova is propagandist is one of the best in the integrated house-building combine. Under the caption "The Practice of Ideological Work" the paper printed an article "Closer to Life," by a member of the methods council on political study of the S. Knyazeva Volgodonskenergostroy Trust.

The problem of providing water, as before, remains acute for Atomash. Because of the insufficient production capacity of the first line of water cleaning installations, Atomash is obliged to use a large quantity of drinking water for industrial purposes. There is one way out of the situation: to put the second unit into operation more quickly. The deputy manager of PromUKS (Industrial Management Organization for Capital Construction) V. Nevmerzhitskiy and the deputy to the chief power engineer V. Soluyanov in an article "In Second Roles" analyze the reasons for the slow pace of operations on this important start-up project.

Under the caption "Manual Labor--on to the Shoulders of Machines" the paper published an article by Z. Bibilova entitled "Dead Souls." This issue also contained articles by V. Navozov, "Initiative and Instruction," and V. Suvorova, "Workable Plans."

## Big Commitments

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 30 Mar 84 p 2

[Text] Volgodonsk residents enthusiastically supported the initiative of Moscow working organizations--to designate April 21 a Communist subbotnik dedicated to the 114th anniversary of the birth of V.I. Lenin. Enterprises and construction sites around the city held meetings and gatherings at which collectives undertook increased work commitments. "SOTSIALISTICHESKAYA INDUSTRIYA at Atomash" in issue No 14 (274) reports this and informs the reader about the active preparation for the subbotnik and about the efforts of construction and operations workers to achieve on this day the highest level of labor productivity.

Volgodonsk management of the Kavsantekhmontazh Trust systematically fails to fulfill the production program. An interview with the deputy manager of the trust by one of the paper's correspondents, is published under the headline "Restore Former Glory." In the interview with deputy manager O. Khachatryan measures being taken to get the organization to keep up with its commitments are discussed.

New standards for servicing heavy and unique metal cutting machines in the first building at Atomash have been developed. How their introduction is going is discussed in an article by Z. Bibikova entitled "Look Before You Leap," published under the caption "Labor Productivity--a Key Indicator."

The article "Going After Good Numbers" by A. Alekseyev and responses to criticisms are published in this issue.

The paper acquaints the reader with a letter to Kuz'ma Volgodonskiy entitled "I Spin as I want," cultural news and sports information.

#### A Winning Work Group

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 5 Apr 84 p 2

[Text] A. Khudyakov's work group of turners and borers has been judged the best among production work teams of the Ministry of Power Machine Building based on last years results. Under the caption "Addresses of Advanced Experience" "SOTSIALISTICHESKAYA INDUSTRIYA at Atomash" published the article in issue No 15 (275).

#### Outstanding Competition Achievements

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 1 May 84 p 2

[Text] The holiday issue of "SOTSIALISTICHESKAYA INDUSTRIYA at Atomash," No 18 (278) opens with reports about Volgodonsk workers' work successes achieved during the days of the pre-May socialist competition. I. Manuylov's work group of slab makers from Otdelstroy achieved a new milestone. It is first at the construction site.

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## PIPELINE CONSTRUCTION

### BUREAUCRATIC DELAYS IN PROVIDING GAS TO RURAL COMMUNITIES

Moscow SEL'SKAYA ZHIZN' in Russian 29 Apr 84 p 2

[Article by Engineer D. Vinogradov, Bryansk Oblast: "Requiring Solution: Gas Pipeline Next Door"]

[Text] In recent years dozens of boiler facilities in Novozybkov have been converted over from solid fuel to cheap natural gas. Gas has also been hooked up to the apartments of many residents of this rayon administrative center. But during this time not one village, not one kolkhoz has been hooked up to natural gas.

And yet the Klintay-Novozybkov trunk natural gas pipeline runs right past the large Udarnik, Novaya Zhizn', and Vpered kolkhozes. A comprehensive construction project is in progress in the villages; most of the housing being erected is two-story, with all utilities. Community centers, schools, preschool facilities, administrative, services, and production-use buildings also need dependable, regular heating.

Yes, natural gas is needed in the villages — everybody understands this fact. Then what is hindering things? It would seem to be a simple matter: kolkhoz boards should order design and estimate documentation, receive a gas allocation, construct a terminal branch from the pipeline and service distribution lines in the village, and every house will receive gas. In fact, however, the process of supplying gas to kolkhoz communities has dragged on and on.

In April 1982 the kolkhozes paid the Bryansk Oblgaz Production Association 28,000 rubles to prepare plans and estimate documentation. A year later the Kiev Transgaz Scientific Research Institute prepared documentation for a terminal branch extending 1,100 meters from the trunk natural gas pipeline, construction of an automatic gas distribution station (AGRS), and housing for operating personnel.

Construction of gas pipelines from AGRS to villages and distribution systems to residences and boiler facilities should be the next stage in providing gas to kolkhozes.



A problem has occurred here as well. It seems that nobody is in a hurry to do the work to provide gas. According to the existing procedure, the USSR Ministry of Gas Industry is supposed to place orders for construction of terminal branch gas pipelines. The RSFSR Ministry of Agriculture is supposed to place orders for laying distribution systems.

Aware of this fact, we requested in advance that the RSFSR Ministry of Agriculture and USSR Ministry of Gas Industry include provision of gas service to the rayon's first three kolkhozes in the 1984 plan. At the beginning of November of last year O. V. Poteryakhin, RSFSR deputy minister of agriculture, reported that construction of this gas pipeline is scheduled for 1985, and the plan has been coordinated with the USSR Ministry of Gas Industry.

Soon thereafter a reply came from the USSR Ministry of Gas Industry. It stated: "The question of constructing the proposed terminal branch gas pipeline will be considered when drawing up the branch development plan for 1986-1990, taking into consideration proposals by RSFSR Gosplan pertaining to construction of terminal branches in the republic as a whole, including Bryansk Oblast."

We could only shrug our shoulders.

Provision of gas to kolkhoz villages in which comprehensive construction is in progress according to the development plan for the RSFSR Non-Chernozem Zone is supposed to improve significantly living conditions for rural toilers as well as resolving other social problems. And it must be accomplished.

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## PIPELINE CONSTRUCTION

### PROGRESS IN NATURAL GAS PIPELINE CONSTRUCTION

Kiev PRAVDA UKRAINY in Russian 16 May 84 p 2

[Article by A. Vesel'yev, USSR deputy minister of construction of petroleum industry enterprises: "Natural Gas Pipelines"]

[Text] As we know, development of heavy industry, and in particular its primary basic branch -- fuel and energy -- constitutes the foundation of successful accomplishment of all economic and social tasks specified by the 26th CPSU Congress and subsequent CPSU Central Committee plenums. In this connection the detachment of construction workers of oil and gas industry enterprises, numbering in the many thousands, have been assigned complex and qualitatively new tasks pertaining to hastening movement on-stream of facilities scheduled in the current five-year plan, facilities for initial-processing and long-distance conveying of natural gas, crude oil, and refined product. Progress in implementation of this large-scale fuel and energy program by the construction people has been highly praised by CPSU Central Committee General Secretary Comrade K. U. Chernenko, chairman of the Presidium of the USSR Supreme Soviet, who noted in a speech to voters that the world has never before seen such a rapid pace of construction of natural gas pipelines as has been achieved in the Soviet Union.

Extensively engaged in socialist competition on the major construction projects of the current five-year plan, the workforces of Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] have achieved new successes in accomplishing targets pertaining to bringing on-stream trunk pipelines and other gas industry facilities. The results of this shock-work labor include ahead-of-schedule completion of the 3-year construction program, and in labor productivity -- attainment of the level specified for the end of the five-year plan. Early completion and startup to full transmission capacity of the Urengoy-Pomary-Uzhgorod trunk natural gas pipeline was the main labor victory of this branch's workers last year.

During the time remaining to the end of the 11th Five-Year Plan the workforces of this branch must concentrate their efforts on prompt, ahead-of-schedule completion of a number of projects which are of exceptional importance for

further development of our national economy. These include first and foremost new gas production facilities at the Urengoy field, ahead-of-schedule completion of the program to build six systems of trunk natural gas pipelines from Western Siberia to the European part of this country, gas distribution lines and terminal branches to power generating plants, etc. One should bear in mind that completion of all these production facilities should be accompanied by completion of housing and social-cultural facilities.

A considerable volume of work in successfully accomplishing this large and intensive program is to be performed by the workforces of Ukrtruboprovodstroy. This year alone the subdivisions of this main administration are to complete such natural gas pipelines as the Shebelinka-Krivoy Rog-Izmail and the Kursk-Kiev pipelines, a terminal branch in Rybnitsa, the second unit of the Lisichansk-Trudovaya-Donetsk-Zhdanov products line, and a section of the Kholmogory-Klin crude oil pipeline. At the same time workforces must provide attendant lines and facilities and hand over completed underground natural gas storage facilities, as well as starting up compressor stations in Mrin, Gnedintsy, Bobrka, and Mashevka.

The workforce of Glavukrneftegazstroy has everything it needs to accomplish these tasks of national importance. Working persistently to implement the party's policy of improving work efficiency and quality, strengthening discipline and orderly procedure in production, the construction people have achieved considerable labor success. The target for the first quarter of this year has been overfulfilled. Excellent results have been achieved by the workforce of the Ukrtruboprovodstroy Trust, which regularly places in All-Union Socialist Competition, and has been awarded a challenge Red Banner of the ministry and Central Committee of the Trade Union of Oil and Gas Industry Workers, based on performance results for 1983.

Spread No 3 of the Glavukrneftegazstroy Trust was named the winner in republic socialist competition. It has been given permanent possession of the challenge Red Banner of the UkSSR Council of Ministers and the Ukrainian Trade Union Council in connection with ahead-of-schedule completion of line construction on the Urengoy-Uzhgorod natural gas pipeline.

The overhead welding brigade headed by V. I. Danno of Construction and Installation Administration-11 of the Ukrtruboprovodstroy Trust, the coating, wrapping and lowering-in teams headed by V. V. Krapivka and M. Ye. Gnativo, Yu. N. Revita's coating and wrapping brigade from Construction Administration-21 of the Ukrtruboprovodstroy Trust plus many others have become competition right-flankers.

Just as in the branch's other main administrations and associations, the workforce of Glavukrneftegazstroy devotes considerable attention to improving efficiency of management, to fuller utilization of production and scientific potential, material, manpower, and financial resources. At the same time the main administration also has its problems and difficulties. These include an inadequate level of development of production bases of the construction

subdivisions. Construction equipment and vehicles are not always used efficiently, and their shift use coefficient is rising rather slowly.

The decisions of the April (1984) CPSU Central Committee Plenum and the address by Comrade K. U. Chernenko at that plenum reemphasized the need to speed up comprehensive improvement of the system of management of the nation's economy and adoption of new forms of economic activity. Such a reorganization is being actively carried out in all subdivisions of our branch. Large cost-accountable spreads, which were first established on the Urengoy-Pomary-Uzhgorod export main trunk natural gas pipeline and which are now in operation on other pipeline construction jobs, are only a small part of this reorganization.

Enormous production and other benefits are promised by extensive adoption of the brigade contract method on construction projects, based on application of the principles of the continuous construction process with people paid on a single job order for the final result. For example, the consolidated combined cost-accountable brigade of the Megiongazstroy Trust headed by Hero of Socialist Labor and deputy to the RSFSR Supreme Soviet N. P. Nezhdanov, has boosted output per worker by 13.7 percent, while the cost of work performed, while maintaining high quality, has been reduced by 23 percent. Recently the ministry board, jointly with the presidium of the Central Committee of the Trade Union of Oil and Gas Industry Workers, examined the performance of this workforce, and recommended that it be disseminated in the organizations of this branch. Workforces patterned after N. P. Nezhdanov's brigade should also be established as rapidly as possible in the subdivisions of Glavukrteftegazstroy.

Reorganization of production links and the entire structure of construction management and the planning and labor incentive system, which is presently being carried out, requires from people a great deal of knowledge, know-how and initiative. This is why higher demands are presently being imposed in our branch not only on the job training of the immediate executing personnel -- the erection and installation people, arc welders, machinery operators and other specialists, but also on training of the commanders of the production -- from brigade leaders to heads of main administrations and associations.

Our paramount task is to unite the trunk natural gas and oil pipeline construction people into solid workforces, operating in a unified rhythm, to help them manifest in full measure the finest professional and patriotic qualities, to transform people's labor enthusiasm into a powerful collective material force.

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## PIPELINE CONSTRUCTION

### INTEGRATED PIPELINE SPREADS BECOMING MORE EFFICIENT

Moscow STROITEL'NAYA GAZETA in Russian 22 Jun 84 p 1

[Article by I. Mazur, chief of Glavtruboprovodstroy: "Pipeline Spread at Work: Glavtruboprovodstroy Chief I. Mazur Tells of the Principal Areas of Activity of the Subdivision He Heads"]

[Text] We owe our success in large measure to the fact that we have done a pretty good job of incorporating integrated spreads, operating on a common work order, and end product sections and brigades, in which elements of the Shchekino method are widely used.

These workforces may contain as many as 400 persons. And all of them, working according to the brigade method of organization of labor and labor incentive, are becoming accustomed to being genuine masters of production, are taking more vigilant note of that which impedes progress, and are innovatively approaching the search for reserve potential.

Analysis of spread operations over the last 5 years indicates that they spent 40 percent of their time on principal job operations, 37 percent on setting up and taking down job operations, and they spent 23 percent of total time on moving to new jobsites. It is precisely here that we are seeking primarily a way to reduce losses both of time and outlays.

Let us say, for example, that the spread headed by A. Buyankin of the Mosgazprovodstroy Trust is completing its section of the Urengoy-Center 2 natural gas pipeline. At the same time its thoughts, figuratively speaking, have long been focused on the Kholmogory-Klin oil pipeline. Engineers, technicians, brigade leaders, and specialists of the principal spread job categories studied the documentation in advance and know what awaits them on the new job today and what they will need tomorrow. In addition, an advance party has been on the new pipeline route for quite some time now.

The new organization of labor has enabled its initiators to rise to a qualitatively new and higher level. The workforces of the vanguard integrated spreads led by Hero of Socialist Labor V. Belyayeva from the welding and installation trust and A. Buyankin from the Mosgazprovodstroy Trust, for example, came forth with the following initiative: "Five-year construction target on the Western Siberia-Center natural gas pipelines in four years."

Others have also taken up the challenge. As a result all plan-targeted jobs were completed ahead of schedule, and it became possible to above-target complete by the end of the year the Yamburg-Center section of the natural gas pipeline assigned to the main administration.

Automatic welding techniques occupy a special place in our job operations. It is no secret that up to the present time half of the pipeline welds in this country have been done manually, but as statistics indicate, the overwhelming majority of defects in welded joints involve manual welding. But now a sufficient number of automatic welders performing resistance welding with powder filler wire have appeared on this country's pipeline construction sites. Our specialists are successfully mastering the techniques and skills of operating this equipment with brigade and individual training methods and schools of vanguard labor. The volume of manual welding on our workforces is scheduled to decline to 40 percent in 1985 and to 15 percent in subsequent years.

We adhere to this approach in earthmoving, hauling, and other operations. Measures devised in this branch give reason to believe that in coming years we shall transition to year-round construction of trunk pipelines across swamps and in permafrost soil, which will make it possible to boost to an even higher level labor productivity, return on fixed capital, and to reduce the cost of construction and installation work.

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## PIPELINE CONSTRUCTION

### PECHORA GRES GAS PIPELINE COMPLETED

Moscow IZVESTIYA in Russian 7 May 84 p 1

[Article by V. Il'in, Pechora-Moscow: "Siberian Gas to the Non-Chernozem Zone"]

[Text] The basic line work has been completed on the natural gas pipeline through which Siberia's "blue" fuel will be conveyed to the Pechora GRES. The welding and installation trust construction workers completed the pipeline, which stretches approximately 100 kilometers, somewhat ahead of schedule.

This is not a large pipeline construction job by today's scale of things. It would be erroneous, however, to assume that a high level of job skill and people's labor enthusiasm can be manifested in full measure only on large trunk pipeline projects. As a rule construction workers building pipeline terminal branches work in areas with a dense network of lines of communication. They must again and again cross rail lines and highways as well as existing pipelines. But they are able to speed up the pipeline construction process even under these conditions.

On the section on which the combined Komsomol-youth brigade led by Aleksandr Matros is working, one senses a precision rhythm, calculated to the minute, and smooth work coordination. Nor is this surprising, because all 70 brigade members have been working together for many years now. Each member has mastered two or three related jobs and is capable of replacing a comrade at any time.

"The average age is 30," relates A. Matros. "We meet workshift targets by 150 to 170 percent. We are working on the basis of a unified work order. We embraced it with our hearts and souls, as they say. Each individual has a strong sense of responsibility toward his job. We have very little defective work and very few mishaps on the job, because everybody has an equal stake in an excellent end result. Therefore I believe that the workforce's present performance level is no limit."

Construction workers say that there are no easy pipeline jobs. There were plenty of difficulties on this job as well. The construction crews have had to cross several highways and more than 30 small rivers and streams.

"One can scarcely exaggerate the importance of Siberian natural gas for our zone," says Construction and Installation Administration-3 chief A. Orlenko. "First of all it will enable us to eliminate the use of coal or, as in the case of the Pechora GRES, fuel oil. This means that the air will be considerably cleaner, and the public will have more public-utility conveniences. Another factor is also of importance: trucks will be freed from the job of hauling fuel."

The development of any branch and sector of the economy is directly dependent on energy availability. And Siberian natural gas is now actively assisting in development of Russia's nonchernozem northern region.

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## PIPELINE CONSTRUCTION

### 'KRONA-1' DETECTS FLAWS IN PIPELINE CONSTRUCTION

Kishinev SOVETSKAYA MOLDAVIYA in Russian 11 Jul 84 p 3

[Excerpt] Flaw detectors which have been introduced into series production at the "Volna" production association in Kishinev ensure highly reliable inspection of the insulation of oil and gas pipelines that are under construction. In field conditions, these instruments make 100-percent checks of the quality of polymer and epoxy coatings which protect pipes against corrosion.

The instrument's sensing device encircles the pipe like a ring and moves along it on bearings. As soon as a microscopic flaw is detected in the insulation, the instrument reports it to the operator by means of a flashing light and a sound signal.

The instrument, which has been given the name "Krona-1", is a versatile one. Quick inspections can be made manually with it. In insulating machines and mobile testing laboratories, it is capable of operating in the automatic mode, marking the place of a defect on a pipe with paint. The apparatus is intended for use in various climatic zones; it operates in a wide range of temperatures, from minus 40 to plus 50 degrees.

The Kishinev association is one of the country's largest suppliers of flaw-detection apparatus. The All-Union Scientific Research Institute for the Development of Non-destructive Methods and Equipment for Testing the Quality of Materials, which is a division of "Volna", has

developed a wide range of instruments and units for various branches of the economy. At enterprises which produce pipe for oil and gas pipelines, this technology is used in the checking of sheet metal and welded joints. The association's trademark is on automated complexes which inspect multilayered pipes at the metallurgical plant in the city of Vyksa.

FID-SNAP

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## PIPELINE CONSTRUCTION

### BRIEFS

**BASHKIRIA OILFIELD TECHNOLOGY--Ufa--**The oilfield workers of Bashkiria have produced more than 100,000 tons of crude and 13 million cubic meters of casinghead gas above and beyond the target since the beginning of this year. With these figures they have met their 6-month pledges and are continuing to work at a rapid pace, endeavoring to complete this year's targets ahead of schedule. The success is due in large measure to the extensive adoption of new equipment and advanced techniques. In particular, many wells are being equipped with modern pumps, and all separation wastewater is injected back into the ground, which helps accomplish more intensive forcing of crude from the formation. Large volumes of carbonic acid and high-pressure gas are being injected into the wells. [By SOTSIALISTICHESKAYA INDUSTRIYA correspondent I. Payvin] [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Jun 84 p 1] 3024

**VOLGA PIPELINE CROSSING--Zvenigovo, Mari ASSR--**A fleet of dredges from the Chernomortekhfлот Administration has arrived at Zvenigovo. This special-purpose flotilla, headed by the dredge "Dunay," will dig the trench for the fourth natural gas pipeline inverted siphon across the Volga. The new underwater crossing will be a backup crossing for the Urengoy-Center 1 natural gas pipeline. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 25 May 84 p 1] 3024

**POLYETHYLENE GAS PIPELINE--Nikolayev--**Specialists from four socialist countries -- Bulgaria, Hungary, the GDR, and Czechoslovakia -- have become acquainted with experience in using polyethylene pipe in the construction of gas pipelines, which has proven quite effective in our republic. The first experiment involving the use of plastic pipe to run gas to towns and villages was conducted several years ago in Novoodesskiy Rayon, Nikolayev Oblast. The project was carried out in partnership with scientists from the UkSSR Academy of Sciences Institute of Electric Welding imeni Ye. O. Paton. A 30-kilometer polyethylene gas pipeline is presently in operation in this rayon. Providing gas to all of Novoodesskiy Rayon using polymer pipe is to be completed by the end of the current five-year plan. [RABOCHAYA GAZETA correspondent] [Text] [Kiev RABOCHAYA GAZETA in Russian 12 Jun 84 p 2] 3024

**MINSK-GOMEL GAS PIPELINE--(BELTA)--**The Minsk-Gomel natural gas pipeline is being constructed at a shock-work pace. It will help solve the problem of providing cheap fuel to industrial facilities and housing in the rapidly-

growing oblast administrative center. In addition, all the cities and towns of Minsk, Mogilev, and Gomel Oblast situated near the pipeline will receive gas. A metallurgical combine under construction in Zhlobin, as well as many other new construction projects of the current five-year plan, are included among the future gas customers. [Text] [Minsk SOVETSKAYA BELORUSSIYA in Russian 8 May 84 p 2] 3024

CASPIAN LAY BARGE--Baku, 9 May--The crew of the specialized vessel "Suleyman Vezirov" has completed ahead of schedule construction of another natural gas pipeline from the Bakhar offshore field to land. Usually pipes are welded into doubles on shore, after which they are transported to the offshore site and laid onto the bottom at the precise point. All this requires a great deal of time and considerable effort by workers and equipment. Now the pipe is welded directly on the deck of the "Suleyman Vezirov." Welds are tested for strength on the spot. Finally the pipe is slid into the sea down an inclined ramp at the stern of the lay barge. [By PRAVDA correspondent L. Tairov] [Text] [Moscow PRAVDA in Russian 9 May 84] 3024

PLASTIC PIPELINES IN TATARIA--Kazan--The first kilometers of plastic gas pipeline in Tataria will be laid this year. Polyethylene pipe for these lines is being manufactured at the Kazan Organic Synthesis Association. Using synthetic materials in construction of gas pipelines promises considerable benefits. Benefits include savings in metal, considerable decrease in labor-intensiveness in gas pipeline construction, as well as easing hauling. Polyethylene pipe up to 90 millimeters in diameter can be... coiled on a drum. This means that it will take up much less room than steel pipe on a truck bed or rail flatcar. In the opinion of specialists at the Tatgaz Administration, the subdivisions of which will be mastering the technique of constructing gas pipelines with the new technology, polyethylene pipe also boasts improved operating characteristics. The interior pipe surface is less rough than that of steel pipe. This will make it possible to convey gas greater distances. Forty-four kilometers of plastic intercommunity connecting gas lines will be constructed this year in Tataria. [By V. Bepalov] [Text] [Moscow SOVETSKAYA ROSSIYA in Russian 1 Jun 84 p 1] 3024

SUMGAIT PIPE TO URENGOY--Sumgait, 9 June (Azerinform)--The steelmaker's hard hat presented to the Sumgait Pioneers by distinguished metallurgical worker Farman Dzhaferov will remind the children of their active participation in Operation "Urengoy." A full steel melt was obtained at the Azerbaijan Tube Rolling Plant Imeni V. I. Lenin from metal collected by the schoolchildren. This first-class metal was used in the manufacture of pipe, which will be sent to Western Siberia. [Text] [Baku VYSHKA in Russian 10 Jun 84 p 3] 3024

URENGOY-SURGUT CONDENSATE PIPELINE--Tyumen Oblast--Lineup and welding operations are in progress in the northern part of this oblast, on the large-diameter Urengoy-Surgut condensate pipeline, Western Siberia's first. So-called "white oil" will be conveyed to the city on the Ob from this famous field. The pipeline is being laid with pipe of half the diameter of the famed trunk natural gas pipelines, but it has its difficulties and requires a high degree of skill on the part of the construction workers. The finest welder brigades, headed by A. Ovsyannikov, V. Krivonosov, and V. Bondarenko of the Severtruboprovodstroy Trust, and USSR State Prize recipient V. Kalenov of

Urengoytruboprovodstroy are fully capable of doing the job. [By IZVESTIYA correspondent Yu. Perepletkin] [Text] [Moscow IZVESTIYA in Russian 4 May 84 p 3] 3024

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## RELATED EQUIPMENT

### SONIC DEVICE LOCATES BREAKS IN UNDERGROUND PIPELINES

Yerevan KOMMUNIST in Russian 15 Jul 84 p 3

[Text] Few can remain indifferent to a ditch dug in a recently paved street. This is not always the result of mismanagement. Often a huge excavation has to be made to find a damaged place in a water pipe, for example. And all because it must be sought blindly. An instrument developed at the Ryazan' Radio Engineering Institute will help to find the exact place of a break and to minimize the sizes of excavations.

"The whole secret of this instrument is its electronic memory," said G. Avguchenko, senior science associate of this institute. "A special device records the normal sounds of a pipeline. An operator walking along the route of the line listens to this sound, and a signaling system is activated at points where the line's sound differs from the norm, which is stored in the memory of a computer. The instrument analyzes the level of interference and determines the point of damage with high precision."

Tests have shown that the new instrument is capable of 'peering' beneath the ground to depths as great as 4 meters and finding points of damage to mains, precise to within 50 centimeters.

FID-SNAP

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## RELATED EQUIPMENT

### PUBLIC WARNING OF GAS PIPELINE RIGHT-OF-WAY HAZARD

Ashkhabad TURKMENSKAYA ISKRA in Russian 7 Jun 84 p 4

[Public notification and warning, by the Shatlykgazdobycha Production Association and the Turkmen Commercial Advertising Agency: "Warning! High-Pressure Gas-Field and Trunk Natural Gas Pipeline"]

[Text] The Shatlykgazdobycha Production Association hereby notifies all officials of construction organizations, establishments, chairmen of kolkhozes and directors of sovkhoses across the land of which high-pressure (to 120 atmospheres) gas-field and trunk natural gas pipelines run that the gas conveyed in these lines presents an explosion and fire hazard; the slightest physical damage to such a pipeline can cause an explosion and fire which could result in loss in human lives.

In order to prevent physical damage to a natural gas pipeline and to prevent accidents, it should be known that a guard strip has been established out to 150 meters on both sides of a high-pressure natural gas pipeline, and a gas field is marked by signs.

#### Procedure of Working in a Restricted Right-of-Way Strip

In order to ensure reliable and safe operation of the Mayskoye-Ashkhabad-Bezmein, Mollaker-TZAP, and Murgab-Bayram Ali high-pressure (to 120 and 55 atm.) gas-field and trunk natural gas pipelines, special regulations have been drawn up, specifying measures to ensure safe performance of agricultural operations, which have been given to all land users across whose land gas-field and trunk natural gas pipelines run:

markers painted red and orange have been placed for the purpose of marking natural gas pipeline rights-of-way, bearing the following warnings: "Gas, Do Not Dig!" "Gas -- Vehicle Traffic Prohibited!" "Gas -- Restricted Zone!" "Gas Field Restricted Zone!" "High-Pressure Gas Pipeline!" Land within a restricted zone remains at the disposal of the land users and may be utilized by them for agricultural purposes, but with prior agreement with the gas production and gas pipelining organizations.

The following are prohibited in a natural gas pipeline and gas field restricted zone:

- to erect buildings or other structures;
- to perform any type of construction, erection, excavation, drilling, blasting, or mining activities;
- to set up field living quarters for farm machinery operators for the period of field work;
- to establishing firing ranges and storage facilities for various building materials, fuels, lubricants and other supplies;
- to pasture livestock, to establish field camps, to station vehicles, or to allow gatherings of people;
- to erect housing structures of any type on plots allocated for individual and group planting of gardens and orchards;
- to cross a natural gas pipeline right-of-way by vehicle other than at designated crossing points indicated by a sign reading "Gas Pipeline Crossing Point";
- to burn bonfires, to light reeds or dry grass;
- to create artificial bodies of water, build dams or weirs, to drop anchor, to build docks, construct beaches, designate fishing areas or to conduct bottom-deepening and dredging operations at natural gas pipeline crossing sites;
- conduct of all types of work activities in a restricted zone or gas field. This requires written authorization from the Shatlykgazdobycha Production Association and ShLPUMG [Shatlyk Trunk Natural Gas Pipeline Line-Production Administration], and work shall be performed only in the presence of a representative of the Shatlykgazdobycha Production Association and ShLPUMG.

Persons who violate regulations governing activities in the restricted right-of-way of a natural gas pipeline and in a gas field, and persons who damage signs and markers will be prosecuted.

Comrade job superintendents, foremen, excavator operators, bulldozer operators, machinery operators, supervisory personnel of transport brigades, kolkhozes, and sovkhoses! Do not forget that it is prohibited to do mechanized excavation in the restricted zone of a natural gas pipeline and gas field, since this can lead to a gas pipeline explosion and to deaths and injuries.

Within gas fields buried gas pipelines are designated by reinforced concrete posts with markers.

Comrades, be vigilant! Do not destroy, damage, or run over restricted area markers -- their absence will create a dangerous situation.

Bear in mind that during the time a buried natural gas pipeline has been in service, agricultural work has reduced its depth, which at the present is 0.8-1.5 meters less, and that pipelines have been damaged by interior and exterior corrosion -- these factors reduce the margin of safety.

Comrades! If you detect leakage of gas at the surface of the ground, immediately report this fact to the Shatlykgazdobycha Production Association, to the closest gas production facility, and to ShLPUMG.

Operators of Earthmoving Equipment!

Demand from foremen, job superintents and crew bosses written authorization from the enterprise operating the natural gas pipeline to perform earthmoving activities.

Pay special attention to the warning signs and markers which indicate the restricted right-of-way of high-pressure natural gas pipelines and a gas-field area.

On all matters connected with the conduct of earthmoving and any other activities in restricted right-of-way zones, within the perimeter of gas fields and on trunk natural gas pipelines, contact the Shatlykgazdobycha Production Association at the following address: Mary Oblast, Sakar-Chaginskiy Rayon, the community of Shatlyk, Shatlykgazdobycha Production Association, telephone numbers 3-17, 3-18, 3-50; in the community of Shatlyk -- 2-55-37, 2-65-71 (via the Mary city exchange). On questions pertaining to trunk natural gas pipelines, contact the Shatlyk Trunk Natural Gas Pipeline Line-Production Administration (ShLPUMG), as follows: Mary Oblast, Sakar-Chaginskiy Rayon, community of Shatlyk, ShLPUMG, telephone numbers 3-61, 3-69, 52-82 in the city of Mary, numbers 5-51-81, 5-59-64 (control room) in the city of Ashkhabad.

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## RELATED EQUIPMENT

### BRIEFS

PIPELINING CONGEALING CRUDE--Shevchenko--As a rule vibration is an undesirable phenomenon. It damages equipment. But the Mangyshlak oilmen are using a special device which causes vibration and which is very helpful in conveying "black gold" by pipeline. Mangyshlak crude is saturated with paraffin and thickens rapidly, especially at reduced temperatures. Plugs sometimes form in the pipelines, halting the flow of crude and shutting down wells. At such times it is necessary to summon the "rescue squad" -- mobile steam generating units which heat the pipe, restoring the flow of crude. A new method of combating plugging by congealed crude has been devised by the people of the Southern Refined Products Administration and the Kuybyshev Polytechnic Institutes. They have devised a simple device which generates vibration where needed on an oil pipeline, helping push through the thickening crude. [By IZVESTIYA correspondent E. Matskevich] [Text] [Moscow IZVESTIYA in Russian 13 May 84 p 1] 3024

GNT-25 GAS COMPRESSOR BLADES--TASS--At the very beginning of 1984 Soviet natural gas from Siberia arrived in France at the end of a pipeline journey of many thousands of kilometers. This event was one more vivid proof of the failure of U.S. "sanctions" to prevent shipment to the USSR of high-output gas compressor and other equipment for construction of the Urengoy-Pomary-Uzhgorod natural gas pipeline. Vyacheslav Anatol'yevich Zavadskiy, cadre worker and grinder at the Leningrad Turbine Blade Plant imeni 50th Anniversary of the USSR Production Association and 1983 winner of a USSR State Prize, has earned the right to stand in the front ranks of those who have proven through deeds the bankruptcy of these "sanctions" against our country. When the question was raised of shortening the time for readying for series production the unique GNT-25 high-output gas compressor units, Vyacheslav Anatol'yevich accepted this task as a most critical assignment. It was necessary to work painstakingly, to come up with unique design solutions before a new process of manufacturing blades for the new unit was brought on-line, in the shortest possible time. Zavadskiy proposed a method and efficient machining regimen which enabled the workforce to accomplish the task assigned it. The blades for the new unit were delivered precisely on schedule to the Nevskiy Zavod Association, manufacturer of the GNT-25 gas compressor unit. Vyacheslav Anatol'yevich is a regular participant in the innovative partnership brigades, which work on developing and perfecting new manufacturing processes. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 10, Mar 84 p 9] 3024

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## ENERGY CONSERVATION

### TURKMEN POWER SPECIALISTS' CAMPAIGN TO CUT COSTS, IMPROVE EFFICIENCY

Moscow ENERGETIK in Russian No 6, Jun 84 pp 20-21

[Article by V. N. Chumachenko, engineer: "Turkmenistan's Power Engineers in the Struggle To Increase Production Efficiency"]

[Text] While implementing the decisions of the 26th CPSU Congress, the groups at the enterprises of Turkmenglavenergo [USSR Main Administration of Power and Electrification] have joined in the fulfillment and over-fulfillment of the assigned tasks set for the 11th Five-Year Plan with respect to economizing on raw-material, other material, and fuel and energy resources, increasing the output of products made from economized raw materials and other materials, putting recycled resources into economic circulation, reducing losses and waste-products of metals, fuel, and energy. Thanks to targeted work by these groups, more than 40 million kW-hrs. of electric power and more than 20,000 tons of standard fuel have been saved.

Economizing on resources is the decisive factor in summing up the results of the socialist competition among the enterprises of Turkmenglavenergo. The widely developed socialist competition for increasing production efficiency served as the basis for the emergence of new patriotic initiatives in the groups. Many of Turkmenglavenergo's enterprises worked under the following slogans: "Economizing on Fuel and Electric Power in Every Work Place" and "Work in Accordance with Personal Accountability for Economizing."

Taking part in this competition are all the workers in the basic occupations: machine operators in the power units of the Maryyskaya GRES [State Regional Electric-Power Station], mechanics working on the boilers and turbines of the Bezmeinskaya GRES, the Krasnovodskiy TETs [Heat and Electric Power Station], and others. In all, there are approximately 1000 persons working in accordance with personal accountability for economizing.

The economic effect derived from introducing personal accountability at the Maryyskaya GRES has exceeded 100,000 rubles. Ensuring the economical operating schedules of the equipment has allowed us to reduce the specific expenditure of standard fuel at this electric-power station from 385.6 grams per kW-hr. in 1973 to 341.2 grams per kW-hr. in 1983.

Introducing personal accountability for economizing at the energy enterprises of Turkmenia excludes the formal approach to the rational and economical utilization of all material resources, since it facilitates the strengthening of controls and stimulates all workers to conserve resources. At the republic's enterprises the savings of diesel fuel for 1982 alone amounted to 46.4 tons, and of gasoline--36.7 tons. Moreover, projects have been carried out with regard to optimizing the operating schedules of electric networks with voltages of 35 kV and higher, the length of time required for repairing the equipment of electric-power plants and networks has been reduced, and this ensured the reduction of the expenditure of electric power for its transportation in 1982 by 1.9 million kW-hrs. and in 1983--by 2.2 million kW-hrs.

Introduction of the program entitled "Balance of Reactive Capacity among Industrial Consumers" allowed us in 1982 to decrease the expenditure of electric power for its transportation in the distributive networks by 0.25 million kW-hrs.

In order to reduce the losses in electric networks, the wires of the overloaded 6--35 kV overhead lines have been replaced over a distance of 316 km, and 8 under-loaded power transformers have been replaced; in addition, 74 power transformers were put into operation, and other measures were carried out which has allowed us to save around 3 million kW-hrs.

The conversion to the planned, 220 kV, Vostochnaya--Kizyl-Arvat Electric-Power Transmission Line, along with the introduction of a complex of progressive technical measures, provided a savings of 3.7 million kW-hrs. of electric power. This is 0.66 million kW-hrs. higher than the planned value. By means of regeneration 10 tons of dampened transformer lubricating oil were restored, and a savings of 12,500 rubles was achieved.

Among the effective developments introduced at TES's [thermal electric-power stations], we should, for example, note the contact-type heat exchanger, which utilizes the heat from discharged smokestack gases. The water heated up in the heat exchanger is used for warming hothouses and preparing feed-water for the boilers of electric-power stations. The economic effect derived from introducing this heat exchanger at the Maryyskaya GRES amounts to 90,000 rubles per year.

In solving the problems of increasing the effectiveness of energy production, observing an economical and thrifty regime, a large role is played by the introduction of new equipment; in particular, during 1982 and 1983, 71 developments of the services and enterprises of Turkmenclavenergo, scientific-research institutes, and other organizations were introduced into production; they have had an economic effect of more than 1 million rubles.

The following have been carried out: repairs, while under voltage, of structural components of overhead line poles of 35 kV and higher in Nebitdagenergo, a complex of measures for ensuring the maintenance of the Bezmelskaya GRES's heating system with softened water, the chromatographic method for determining the degree of damage done to transformers by the composition of gas at the Krasnovodskiy TETs and in the Ashelektro Network, with economic effects of 150,000, 125,000, and 72,000 rubles respectively.

A great deal of work with regard to economizing on fuel-and-energy resources at this republic's industrial enterprises has been conducted by Gosenergonadzor [State Inspectorate for Energy Engineering]. In 1983 alone they increased the payment to 160 enterprises by a total of 8,918,000 rubles for exceeding the plans for electric-power consumption.

Qualified surprise inspections, conducted at a large group of enterprises, allowed us to discover non-productive losses of 13.5 million kW-hrs. of electric power and 100,000 GCal. of heat, as well as reserves for economizing amounting to 8.7 million kW-hrs. of electric power and 8,500 GCal. of heat per year. At the same time, more than 2.9 million kW-hrs. of commercial losses of electric power occurred.

Instances of mismanagement and wasteful expenditure of energy resources have been subjected to criticism in the republican, oblast, and rayon-level newspapers, naming the negligent managers of enterprises, organizations, and construction projects. In accordance with such alarm signals, the necessary measures have been taken to punish the guilty persons. All this has facilitated an improvement in the degree of preservation of the people's property and the eradication of an unbusinesslike attitude toward material values.

Active work with regard to explaining the tasks and conditions of inspection is constantly being conducted by the inspection commission under Turkmenglavenergo; it conducts surprise raids to check up on the observance of the regulations on storing and utilizing materials and, in conjunction with production personnel, develops measures to reduce the norms of expending materials and to reduce above-norm supplies of material valuables.

Great successes have likewise been achieved in the introduction of efficiency proposals, aimed at economizing on fuel, metal, and other material resources.

Conscientious work by Turkmenia's energy engineers on the march of the five-year plan is making a substantial contribution to the country's economy.

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## GENERAL

### WEST SIBERIAN OIL, GAS COMPLEX IN NEW ORGANIZATION STAGE

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA OBSHCHESTVENNYKH NAUK in Russian No 3, Sep 83 pp 30-39

[Article by B. P. Orlov and V. N. Kharitonova of the Institute of the Economics and Organization of Industrial Production, SO AN SSSR [Siberian Department, USSR Academy of Sciences] (Novosibirsk): "The Shaping of the Areal Structure of the West Siberian Oil and Gas Complex"<sup>1</sup>]

[Text] The West Siberian Oil and Gas Complex (ZSNGK) now supplies the country's economy about half of the oil and natural gas recovered in the USSR. In the foreseeable long term (up to the year 2005) an intensification of the ZSNGK's role as the country's main fuel and power base is practically inevitable. This presupposes the integrated economic development of an enormous region which covers almost the whole of Tyumen Oblast and a large part, mainly the northern part, of Tomsk Oblast. The lands of this region can be divided into four economico-geographic zones, which are distinguished a) by natural and climatic conditions; b) by the makeup and quantitative nature of the natural resources; c) by the degree of economic development and settlement of the land, and d) by the presence of a production potential and a structure for the economy. These are the Arctic Zone,<sup>2</sup> the Far North, the Near North and the Southern Zone of the region.

The demarcation of the chosen zones which is proposed below is based upon certain a priori arguments and not on the results of special research in economic geography, and, therefore, should be viewed as a preliminary opinion, as a working hypothesis.<sup>3</sup>

The Arctic Zone is located beyond the Arctic Circle. The Yamal Peninsula oil and gas fields, the Yamburg and Zapolyarnoye gas and condensate fields, and so on, have been explored here. As of today the Arctic Zone practically has not been developed economically. The medical geographers consider it unsuitable for lengthy, much less permanent habitation by outsiders. Construction costs here exceed those for the Far North 1.5-fold to 2-fold, for the Southern Zone 3.5-fold to 4.5-fold.

The Far North has a southern border of 63 degrees N. Gas-condensate and oil-and-gas condensate fields are located in this area. The zone is marked by natural and climatic conditions that make human habitation difficult and by

low population density. In the opinion of prominent researcher Academician of the SSSR AMN [USSR Academy of Medical Sciences] V. P. Kaznacheyev, only a small portion of the temporary workers and immigrants from other regions can live here and settle down for a long time without getting sick. Therefore, it is desirable, in developing this zone economically, to be oriented to periodic change of the outsider population. When the ZSNGK was formed, the Far North practically did not have an industrial potential. The level of expenditures for nonindustrial construction and for economic preparation of the region here was 1.5-fold to 2-fold higher than in the Near North.

The Near North\* lies within the Khanty-Mansiysk Autonomous Okrug, and also the Aleksandrovskiy, Parabelskiy and Kargasokskiy Administrative Rayons of Tomsk Oblast, and its southern boundary passes along 58° N. This zone is suitable for permanent habitation of a population of outsiders, and there is a limited potential for agricultural output. The main natural resources of national-economic significance are water, peat and timber. When the ZSNGK was formed, only the logging industry had been developed. In 1965 fewer than 5 percent of the population of Tyumen and Tomsk Oblast lived here. Construction cost levels were 1.5-fold to 1.7-fold higher than in the Southern Zone.

The Southern Zone embraces the area of Tyumen Oblast that lies north of the 58th parallel, on which Tobolsk is situated. This is a relatively developed zone with such branches of specialization as machinebuilding, woodworking and the foodstuffs industry. The main natural resource is the land: its agricultural land yields up to 90 percent of Tyumen Oblast's gross agricultural output. When the development of oil and gas resources started in the Southern Zone, 80 percent of the oblast's population lived in that zone, and it yielded more than 70 percent of the oblast's gross industrial output. The ZSNGK's Southern Zone can include, with a certain arbitrariness, the city of Tomsk, where a large chemical industry center is being formed: it looks on said complex as a source of primary raw materials.

Thus, the forming of the country's new fuel and power base required the economic development, including the transport development, of a vast area that previously had not possessed any kind of substantial production potential.<sup>5</sup> Naturally, solution of the economic problems posed to ZSNGK were divided into several stages, each of which was marked by a level of achievement of the assigned missions (the amounts of oil, gas and condensate recovered), the resource potential of the economy, and the areal economic development of the region.

The creation of large regional production complexes and industrial clusters that are based on the development of oil and gas fields and the erection of capacity for refining hydrocarbon raw materials were chosen as the basic strategies for forming the ZSNGK's areal structure. In so doing, attention had to be paid to these principles: the initial investment was aimed mainly at developing the oilfields, and the organization of natural-gas recovery was assigned a secondary role. Then, back in the second half of the 1970's, the policy was adopted of building up natural-gas recovery at an outstripping rate. In 1975 oil recovery exceeded gas recovery almost 4-fold, in 1980 only 2-fold. Under the first twenty-year plan (1966-1985), this complex was to be developed as an oil and gas complex, but during the second one (1986-2005) it will be transformed into a gas and oil complex.

From the point of view of the areal structure, the principle noted manifested itself in the fact that economic development was and is proceeding in the broad direction of south to north: at first this embraced the Near North, then the Far North, and, finally, the Arctic Zone. Such a trend signifies in practice the sequential complication of objective (natural and economic-geographic) conditions of the economic activity and of life support for the people.

When the ZSNGK was formed (1966-1975),<sup>6</sup> the job of creating the country's chief oil recovery base was posed as the main task. Along with this, the task of developing natural-gas fields was resolved, at first fields that were small in reserves, and then the first of the large fields--Medvezhye. The main target of investment in the ZSNGK was the Middle Ob.

The first step was marked by large-scale economic development of the Near North, the creation of industrial clusters in the Far North, the construction of pipelines to connect the oil and gas recovery centers with the main customers in the European part of the USSR and in the south of Siberia, and the erection of the Tyumen-Surgut railroad as the base for the future transport network of the whole region and of port facilities for river transport.

The Southern Zone's economy filled the role of a support base for developing the oil and gas region: the main scientific-research, design, and design-development organizations, and plants for repairing equipment and for creating integrated modules for developing the oilfields were located here. Tyumen and Tobolsk were of especially great importance in providing for the importation of freight into the oil and gas regions: in the absence of year-round common-carrier transport, 80-95 percent of the freight was imported by river. In this situation, the main capacity of the staging bases was sited in Tyumen and Tobolsk, with the use of which freight was transferred from rail to river transport.

Among the cities of the ZSNGK's Southern Zone, it was mainly Tyumen that performed the functions of servicing the oil and gas regions, and, because of this, it was transformed into a large industrial cluster with a new specific orientation. Tomsk played a similar role in relation to Tomsk Oblast's oilfields, although on a far lesser scale. Tobolsk at this stage still had not been formed as an industrial cluster (its role in transporting freight was purely intermediary). The Southern Zone was the main foodstuffs base for the oil and gas regions.

During the stage of forming the ZSNGK, several industrial clusters (PU's) which were distinguished by the structure of economic activity and the size of the population arose in its area. In the Middle Ob these were the Surgut, Nizhnevartovsk and Nefteyugansk PU's, which are located in Tyumen Oblast, the Strezhevoy in Tomsk Oblast, and in the Urals, the Uray PU, where the first oilfield facilities were established. These industrial clusters rose up in the Near North Zone. The forming of the Nadym PU was started in the Far North.

An important feature of the areal structure of the ZSNGK's economic activity during the first stage was the relatively noninteracting development of the emerging industrial clusters. Their economic ties for resources consumption

were oriented to either the complex's Southern Zone or the USSR's European area (including the Urals), or--partially--West Siberia's contiguous oblasts. Ties between the industrial clusters of the oil regions at this stage were mainly of a mediated nature: the commonality of the specific task (the establishment of the country's main petroleum base) united them. Direct ties (exchange of population and regional redistribution of equipment and production collectives) were relatively weak. Economic ties between the industrial clusters of the oil regions (the Near North and the gas regions (the Far North) were practically absent.

#### A Brief Description of the Modern Areal Structure.

During the 10th Five-Year Plan a trend toward merging industrial clusters that previously were separated from each other into a single regional production combination of higher rank--a regional production complex--manifested itself. This was the result of a strengthening of previously and newly emerging economic ties among the various PU's--for the production and consumption of casing-head gas, electric power, constructional structure, repair service, population migration and labor resources, the training and utilization of specialists, and so on. The creation of large facilities on the intraregional level (GRES's, DSK's [housing construction combines], and so on) and of a unified transportation network played a decisive role here. The Middle Ob TPK (regional production complex) was the first to be formed in the ZSNGK's area.

Up to the present, the areal structure of the ZSNGK's economic activity has been represented by the following regional-production combinations--the Middle Ob TPK, the Strezhevoy and Uray industrial clusters in the Near North Zone, the North Tyumen TPK in the Far North, and the Tobolsk and Tyumen industrial clusters in the Southern Zone. The Middle Ob TPK has the leading role in creating the country's petroleum base in West Siberia. It includes the Surgut, Nizhnevartovsk and Nefteyugansk Industrial Clusters.

Branches of Middle Ob TPK specialization are oil recovery and primary gas treatment. Since 1973, 95 percent of West Siberia's oil has been recovered here. In 1981 the level of its recovery (together with condensate) reached 300 million tons, which comprised 49 percent of All-Union production. Forty-five percent of the treatment of oil (casing-head) gas in the USSR is concentrated in the Middle Ob TPK. This will enable about 70 percent of the casing-head gas resources taken from Middle Ob fields to be used in the economy. Dry gas obtained at the gas-treatment plants is used as fuel at the Surgut GRES, but the greater part of it is sent over the Nizhnevartovsk-Parabel-Kuzbass [Kuznetsk Coal Basin] trunk pipeline for the needs of metallurgical and chemical industries. Another product--unstable gasoline--is a petrochemical raw material for producing organic-synthesis product. The Tobolsk Petrochemical Combine (NKhK) was to be an economically effective customer for the unstable gasoline of the Middle Ob TPK. Because of a stretchout of the period for creating it, this Middle Ob TPK product is being used at existing plants of the Urals and Volga regions.

The TPK's servicing industries are: power engineering, the building-materials industry, logging, the repair business, and the supplying of materials and



equipment. The intraregional transportation network is represented by the railroad, waterways, pipelines and airline routes. Middle Ob river ports handle about 30 percent of the ZSNGK's freight and cargo.

The Surgutskaya GRES-1, which was built during the Ninth Five-Year Plan, has the best technical and economic indicators in the Tyumen power system. It is a generator of electricity for the Middle Ob TPK.

Capital investment in the Middle Ob TPK's economy doubled during the 10th Five-Year Plan. In 1980, 60 percent of the capacity of ZSNGK construction organizations was concentrated here. While fulfilling the investment program, close production ties arose among the industrial clusters on the use of capacity and of specialized-organization personnel for building roads, pipelines and the power grid.

The Surgut Industrial Cluster is the main center for locating regional-level servicing industries. In particular, the Surgut DSK's output is sent to Nefteyugansk and Nizhnevartovsk.

The base of the system for settling this TPK's people are the cities of Nizhnevartovsk, Surgut and Nefteyugansk, with relatively developed social and domestic-services infrastructures. They are bases for the rotating-duty style of operation at oilfields. About 40 percent of those employed by the ZSNGK reside in the Middle Ob TPK. Its industrial potential also is high: in 1980 more than 50 percent of the gross product of Tyumen Oblast's industry was produced here.

The Middle Ob TPK production staff that was formed was grounds for the further concentration at that TPK of ZSNGK service branches up to the inter-regional level. It has become possible to transform the Middle Ob TPK into a support base for developing the oil and gas regions of the Far North. During the 11th Five-Year Plan this TPK began to transmit electricity to the north. Its construction organizations became bases for performing construction work in the Pura region (the cities of Noyabrsk and Tarko-Sale). Surgut builders are erecting power lines throughout all of Tyumen Oblast. Deliveries of constructional structure to Urengoy and Noyabrsk have started.

The bases for the North Tyumen TPK as the gas-recovery base for the USSR were laid during the 10th Five-Year Plan. In 1981 its share in the All-Union natural-gas recovery exceeded 30 percent. The Nadym Industrial cluster, which was established in 1971-1977, is playing the role of support base at the pioneering stage of forming the Urengoy Industrial Cluster (with the center at Novyy Urengoy), is sending constructional structure and is supplying materials and equipment. Eighty percent of the freight arriving at the Urengoy PU is imported through the Nadym riverport and the railroad that links up with it.

The regional economy of the North Tyumen TPK is, as a whole, in the pioneering stage of its development: the pace and volume of capital construction of industrial clusters, and, consequently, also, the level of development of the gas industry are determined mainly by the amounts and periods of shipments of industrial output from other parts of the country. With the turnover of

the Surgut-Urengoy Railroad for permanent operation, direct ties of the North Tyumen TPK with bases that make up integrated freight shipments, which are sited in the Tobolsk Industrial Cluster, are emerging.

The Tyumen and Tobolsk Industrial Clusters initially were developed relatively independently. During the 10th Five-Year Plan mutual ties between them were greatly strengthened, supplying a basis for proposing the possibility of creating in the future a Tyumen-Tobolsk TPK based upon them. The Tobolsk PU is, in practice, linked almost not at all with either the North Tyumen or the Middle Ob TPK's as a producer of output and consumer of raw materials. Because of a delay in construction of the Tobolsk NKHK, losses of unstable gasoline (one of the products of gas treatment) during the 10th Five-Year Plan equaled the annual amount of this raw material that the combine will consume when it comes up to design capacity. Tobolsk is linked with the Middle Ob TPK for supplying materials and equipment for the ZSNGK. The Tyumen PU has relatively minor ties with the North Tyumen TPK (not counting the supplying of materials and equipment and nonproduction functions). The production of integrated module installations for gas-field construction still has not been widely developed.

Despite the existing deviations from balanced development of regional production combinations (TPS's) within the ZSNGK, it should be recognized that, on the whole, implementing the strategy of forming it by creating TPK's and PU's has brought significant results.

In the second half of the 1970's, the ZSNGK entered a new stage of development: its role rose considerably during 1976-1983 in forming the country's fuel and power resources and in exporting them, and objective conditions arose that stimulated complication of the complex's branch structure and a further shifting of productive forces to the North. The indicated decade can be considered the starting period of the new stage, and it is still impossible to say relatively precisely how long it will last because of indeterminacy of the forthcoming development of productive forces. It can only be supposed that during the forecast period (1986-2005) the principles that were contemplated for the start of the 1980's will manifest themselves. Since changes in the ZSNGK's areal structure will be determined precisely by them, we shall describe these principles briefly.

#### Basic Features of the New Stage of ZSNGK Development

The most general principle of ZSNGK development consists in a strengthening of its role in the forming of the country's fuel-and-power and raw-material resources. The purpose in creating the complex was to organize the country's main oil base and a large national base for natural-gas recovery. This purpose was achieved: in 1980, ZSNGK's share in All-Union recovery was raised to 52 percent for oil and gas condensate and to 36 percent for natural-gas recovery.

In the foreseeable long term, the assigned mission will acquire a different qualitative and quantitative content: West Siberia is being transformed into the main producer of hydrocarbon raw materials in the USSR, and it is providing for all the growth in the country's oil, gas-condensate and natural gas

recovery (during the 10th Five-Year Plan this was done only for oil recovery). Already, under the 11th Five-Year Plan, it is planned to raise ZSNGK's share in All-Union oil recovery to 62 percent, natural gas to 53 percent.<sup>7</sup>

A new aim has been added to this one--the promotion of which is substantiated by economic effectiveness in the refining of hydrocarbon raw materials--the creation within Tyumen and Tomsk Oblasts of an All-Union chemical-industry base and the organization of other production operations which will process primary raw materials.

The logical continuity of these missions for ZSNGK development--conversion from the recovery of primary raw materials to the local refinement thereof--should be noted.

The general principle of ZSNGK development stated above is supplemented by principles of a specific nature.

1. The gas industry will be developed at an accelerated rate in comparison with the oil industry (as was already mentioned above), since the share of natural gas in the structure of the USSR's fuel and power balance during the forthcoming twenty-year plan will be sharply increased.<sup>8</sup> It can be expected that by 1990 the recovery of natural gas will exceed that of oil.
2. Centers for natural-gas recovery will be shifted to the north and northeast, oil-recovery centers to the north. Because of this, the shift in investment activity from the Near North to the Far North, and, partially, to the Arctic Zone, is inevitable.
3. The wide involvement of Near North fields in development is complicating the problem of coordinating strategies for developing the oil, lumber and woodworking branches of industry and wood chemistry. The increase in capital investment in oil recovery limits the potential for financing capital investment in the development of a forestry-industry complex and postpones the dates for erecting logging and processing enterprises. The realization of nature-conservation measures is hampered. At the same time, in laying down transport lines (pipelines, highways and LEP's [power transmission lines]), a large amount of wood raw material is formed that is suitable for various uses.
4. The composition of ZSNGK's specialized branches will be augmented by the oil, gas and condensate processing industries, petrochemicals, electric power and the microbiologicals industry. The options in deployment of the corresponding enterprises and in the regional concentration of production facilities thereat are not as obvious as for the recovery branches.
5. Savings in transport expenses and considerations of supply reliability suggest that capacity for producing and repairing equipment for oil and gas field facilities, woodworking and housing construction be sited in the ZSNGK's territory.

Expansion of the branch-of-industry composition of the ZSNGK will cause complication of the economic structure of some regional-production combinations and a strengthening of production and other ties among the various TPS's [regional production combinations]. Consequently, under the new situation,

proportions of the division of labor within the complex, that is, the division of labor among regional production combinations, should be formed that are different from previous proportions.

The supporting transportation network is a connecting link in the ZSNGK system of regional production combinations. The prospects for forming and developing it will exert a determining influence on intraregional (within the ZSNGK) division of labor. It should be noted that its throughput and the number of outlets to the country's unified transport network can exert a restraining influence on further development of the ZSNGK.

#### The Probable Trend in TPS Development

A preliminary analysis of possible directions for developing and deploying specialized and outfitting branches of the ZSNGK will enable the following hypotheses to be advanced. It is correct to consider as inevitable: a) the emergence of new TPS's in the ZSNGK's area; b) a strengthening of the region-wide functions of the Middle Ob TPK and the Tyumen Industrial Cluster; and c) the integration of independent PU's into new TPK's (the North Tyumen and the Tyumen-Tobolsk TPK's, where the trend toward unification has already manifested itself).

The creation of the Urals and North Tomsk TPK's in the Near North and the Noyabrsk in the Far North is extremely probable. Before the year 2005 the emergence in the Arctic zone of industrial clusters based upon the development of oil and gas fields of the Tazov and Yamal Peninsulas is possible.

The Urals geographic area includes the lands of Tyumen Oblast's Oktyabrskiy and Kondinskiy Administrative Regions. Prospects for forming a regional production complex here is associated with the development of oilfields of the Krasnoleninsk dome and the potential for creating a large power center in the region of Sergin and Nyagan that will be capable of covering part of the Urals' requirements for electricity.

In the matter of siting power capacity, it will also become possible to deploy here large gas-chemicals complexes, based upon natural gas (the production of methanol, protein and vitamin concentrates, and so on). The presence of thermal electric-power stations and of water resources is favorable to the deployment of oil-refineries for the severe refining of crude.

This geographical region possesses substantial forestry resources: it has 50 percent of the sustainable reserve of timber in Tyumen Oblast's forestry-operating region.<sup>9</sup> This timber raw-materials base is adequate, along with the development of traditional logging, to deploy here a timber industry with a capacity for producing building items, constructional structure and wooden housing to the extent of up to 500,000 m<sup>2</sup> per year for ZSNGK needs. There are also design studies on substantiating the siting of pulp production for making integrated use of forestry resources.

Thus, the oil, gas-chemicals and forestry industries and electric-power generation are possible branches of specialization of All-Union significance for the Urals TPK; and oil refining and wood-processing are branches of regionwide significance.



In the North Tomsk geographic area, a large regional production combination can be established, based upon the Strezhevoy Industrial Cluster and development of the oilfields north of it and also of the Myldzhino gas field. In substantiating the long-term structure of the combination's economic activity, the desirability of orienting its production ties to the south of Tomsk Oblast, and also of orienting a portion of the capacity of the Asino LPK [Lumber Industry Complex] to satisfying the woodworking-products requirements for building the oil-and-gas complex should be examined. Study of the question of building a railroad to the east from Nizhnevartovsk is urgent. This mainline should be able to give ZSNGK a new outlet to the northeast regions of West Siberia, which will be able to send the ZSNGK metal, machinebuilding output and constructional structure. Moreover, the presence of a rail mainline would help to strengthen economic ties between the Tyumen-Tobolsk and Middle Ob TPK's and the Tomsk Industrial Cluster, which would increase flexibility in shipments of freight--products of the investment branches in the ZSNGK.

In the Far North Zone, one of the first priority targets of economic development is the Noyabrsk geographic area. Its southern boundary passes along the city of Noyabrsk, the northern one along the Tarko-Sale settlement. A large oil and gas recovery complex can be formed on the basis of the Middle Ob's northern oilfields, the Vyngapur gas field, and oilfields in the south of the Yamal-Nenets Autonomous Okrug.

Noyabrsk is on the Surgut-Urengoy mainline, which is a good reason for creating here a large transport center and a base for supplying materials and equipment to the oil and gas fields--the Gubkinskoye, Komsomolskoye and Tarko-Sale--of the Pura region.

Also possible is the deployment in this geographic area of gas and gas-condensate refining capacity, provided it is created in the "northern" version. The climatic conditions in this geographic area are more severe than in the Middle Ob. Therefore, it is desirable to limit as much as possible the deployment here of repair facilities and of people. Along with an orientation to labor-saving technology and methods for organizing production, especially in the service branches, wide use must be made of rotating-duty expeditionary personnel methods in building up oilfield facilities.

The North-Tyumen TPK will continue to be formed as the country's gas-recovery base. The source of its later growth will be development of the Yamburg, Zapolyarnoye and Tazov fields.<sup>10</sup> New specialized branches--oil and condensate recovery--can appear here during the 12th and 13th Five-Year Plans.

The deployment of condensate-refining for energy-complex needs, and meeting TPK's requirements for combustibles, lubricants and motor fuels, is possible.

A prerequisite for reliable and effective energy saving for the North Tyumen TPK is the creation of a large gas-fired electric-power station at the TPK itself. A target of first-priority construction is the Urengoyetskaya GRES. Linking it up with the Tyumen power system will improve considerably its flexibility and will increase reliability in supplying electricity for the whole ZSNGK.

The main direction for substantiating the scale of development and the structure of this TPK's servicing branches is a study of technological and organizational methods that will allow the time taken to create capacity therefor to be reduced, and, at the same time, will provide for its operating reliability. In this connection, the deployment in the Middle Ob, the Urals (wood-working products) and the Tyumen-Tobolsk TPK of repair and production facilities for certain types of constructional structure for the North Tyumen TPK should, apparently, be assessed as alternatives. Let us note that, given the modern level of development of transport ties, the factor of reliability of shipments plays a determining role in deploying repair services and housing-construction enterprises in the Far North itself, but particularly in the Nadym and Urengoy Industrial Clusters.

The problem of using the rotating-duty expeditionary personnel method is sharper in the North Tyumen TPK than in the Noyabrsk geographic area.

Let us examine the possible role of the Middle Ob TPK in shaping the ZSNGK's long-term areal structure. In the foreseeable long term, this TPK will, as before, be the main oil base in the ZSNGK. During the 11th Five-Year Plan this is the most developed regional complex within the petroliferous province, which is marked by a high level of concentration of construction capacity and by the presence of a relatively developed social and domestic-services infrastructure. There is a fuel base here for creating additional electric-power generating capacity and bases for developing large railroad junctions and a base for industrializing construction work.

These factors, in combination with the central location of the Middle Ob TPK in the ZSNGK are favorable for deploying there new processing-type production facilities, whose output can be aimed at meeting the needs of the West Siberian oil and gas complex: condensate refineries for fuel duty, oil refining with high output of a broad range of light petroleum product (gasoline and lubricants), and a forestry-industry complex.

The deployment of these production facilities in the Middle Ob TPK would enable the load to be reduced on both the southern part of the regional transportation network and the interregional transportation network. The fact is that the raw-materials base for branches that are proposed for deployment is either in the Middle Ob itself or in the North Tyumen TPK, while the output of these branches is intended basically for the oil and gas regions.

The long-term development of electric-power in the Middle Ob TPK that is being examined goes beyond the framework of the integrating branches. Already now Surgutskaya GRES electricity is arriving in the North Tyumen TPK and the Strezhevoy Industrial Cluster. The raw-materials potential and the development of power-construction capacity by the start of the 12th Five-Year Plan are good grounds for creating in the Middle Ob TPK a large power center for the whole ZSNGK. A wood-processing industry also can be developed.

The prerequisites exist for creating capacity for the servicing industries, which will be oriented to meeting a substantial portion of the Far North's requirements for repairing equipment, including transport equipment, and also for organizing educational institutions for training qualified personnel.

One of the probable alternatives in developing the Middle Ob TPK can be the forming here of facilities for supplying materials and equipment (warehouses and storages) for the Noyabrsk and North Tyumen TPK's. This could reduce the load on the entries to the ZSNGK at Tyumen and Tobolsk, since a part of the freight for the indicated regions could be sent by river to Surgut, with later reshipment by rail.

At the same time, the permissible bounds for concentrating electric-power capacity, processing-production facilities and repair enterprises can, apparently, be determined by ecological conditions, a shortage of regional sites, the labor intensiveness of construction and repair, and the potential for providing the populace with the services of the social and domestic-services infrastructure by the contemplated deadlines.

In Tyumen Oblast's Southern Zone, as has already been noted, the Tyumen-Tobolsk TPK can be formed within the period being examined. Its prospects are linked with the development of petrochemistry as the basic branch of specialization (the introduction of the Tobolsk NKHK into operation being a first-priority task), and also with a wider orientation of its production staff, scientific-research potential, design-development institutions, and so on, toward servicing the ZSNGK's northern zones. It is desirable to create here capacity for machinebuilding and wood processing and a repair activity, to increase the output of foodstuffs, and to develop a network of vuzes, tekhnikumskums and vocational and technical schools.

In general, the ZSNGK's areal structure will be changed considerably at the new stage of its development. In this connection, it is important during the preplanning-research stage, to work out schemes for optimizing the siting of productive forces. In so doing, it is necessary to find a rational structure for the economic activity of each regional-production combination and the economically justified ties among them.

#### FOOTNOTES

1. The first research in this area was performed at the start of the 1970's by USSR Gosplan's SOPS [Council on Study of the Productive Forces] under the supervision of D. V. Belorусov. (See, for example: Belorусov, D. V. et al. *Problemy razvitiya i razmeshcheniya proizvoditel'nykh sil Zapadnoy Sibiri* [Problems of Developing and Deploying West Siberia's Productive Forces]. Moscow 1976).
2. Various researchers consider that the Arctic Zone should be included in the Far North as a subzone.
3. See: Khaytun, A. D. *Ekspeditsionno-vakhtovoye stroitel'stvo v Zapadnoy Sibiri* [Rotating-Duty Expeditionary Construction in West Siberia]. Leningrad, 1982.
4. V. I. Botvinnikov was one of the first among the researchers to describe the borders of Siberia's Near North. See: Botvinnikov, V. I. "The Question of the Concept of the Economic Development of the Central Belt of Siberia and the Far East." *IZV. SO AN SSSR*, 1973, No 6, SER. OBSHCHESTV.

NAUK [Herald of the Siberian Department of the USSR Academy of Sciences], No 6, 1973. [Social Sciences Series], No 2, pp 28-33.

5. A retrospective analysis of forming the regional activity of ZSNGK [West Siberian Oil and Gas Complex] was given in the work: Aganbegyan, A. G., Vyzov, S. V., Orlov, B. P. and Kharitonova, V. N. "A New Step in Development of the West Siberian Oil and Gas Complex." In the book, "Sibir' v yedinoe narodnokhozyaystvennoye kompleks" [Siberia in the Unified National Economic Complex]. Novosibirsk, 1980.
6. The commercial recovery of oil was started in 1964. The first million tons of crude were obtained in 1965, and the first relatively large gas field [according to the criteria of other recovery regions]--the Punga--began to operate in 1966, and recovery here exceeded 0.5 billion m<sup>3</sup> somewhat. Consequently, the start of the forming of said complex can, with a certain arbitrariness, be ascribed to 1966. The completion of this stage came in about the middle of the 1970's.
7. Orlov, B. P. "The Development of Siberia's Economics at Various Stages of Socialist Construction." IZV. SO AN SSSR, No 11, 1982, SER. OBSHCHESTV. NAUK, No 3, page 68.
8. Makarov, A. A. and Melent'yev, L. A. "Problems and Routes for Developing the USSR's Power." EKO [THE ECONOMICS AND ORGANIZATION OF INDUSTRIAL CONSTRUCTION], No 3, 1981, page 33.
9. Blam, Yu. Sh., Voyevoda, I. N. and Kuleshov, V. V. "The Simulation of Interaction in Development of the Oil and Gas Complex and Lumber-Industry Production in West Siberia." In the book, "Modelirovaniye razvitiya Zapadno-Sibirskogo neftegazovogo kompleksa" [Simulation of the Development of the West Siberian Oil and Gas Complex]. Novosibirsk, 1981, p 97.
10. The Yamburg field is located in the Arctic Zone, close to the geographical boundary that separates the Far North from this zone (the Arctic Circle). Since, however, this field is being developed from Nadym, we consider it proper to include Yamburg within the North Tyumen TPK that is being formed and is located within the Far North Zone.

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## GENERAL

### WEST SIBERIAN OIL, GAS COMPLEX ANALYZED AS MODEL FOR FUTURE

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[Article by A. D. Khaytun of NIPIONeftegazstroy [Scientific-Research and Design Institute of the State Trust for the Industrialized Construction of Oil and Gas Industry Enterprises] (Moscow): "Stages in the Forming of TPK's and the Social Development of the Territory"; passages rendered in all capital letters printed in boldface]

[Text] The production, economic and social problems of forming the West Siberian Oil and Gas Complex are rightly arousing the attention of economic theory: here, in actual fact, statements about the principles of forming regional investment and production systems of importance to the national economy that have been advanced are being checked, and scientific concepts of development are being tested for soundness. Many years of experience in solving these problems are compelling certain questions which, it would seem had been studied well and seemed to be indisputable, to be reinterpreted. This work examines some of them: a) the conceptual relationship of the branch (or interbranch) complex and the regional production complex; b) regional and branch aspects of improving the economic mechanism; c) the interrelationships of production development of a complex and of the socio-economic development of the region; and d) the principles of positive use of objective contradictions in developing the complex and the territory.

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For a scientific analysis of the more essential indications of the production-economic and social development of the northern oil and gas provinces of Tyumen and Tomsk Oblasts, it was required that the content of the concept, "interbranch complex," which was previously studied relative to a rapidly progressing part of the country's fuel and power system--the oil and gas industries, be rethought.<sup>1</sup>

An interbranch national-economic complex is a community of like-type branches joined by the full or partial interchangeability of output or by the sequence of the stages of its processing. The economic and administrative independence

of each branch is preserved. The complex embraces the whole investment-production process, from the design and creation of fixed capital to production of the final output and its shipment to customers. All these features are manifested in the oil and gas complex, which includes the oil and gas industries, which, in turn, include the pipeline transport of oil and gas, the construction of oil and gas industry enterprises, and geological exploration, as well as the infrastructure of the new regions of concentrated oil and gas recovery.

The model of an interbranch regional complex of the national economy was a projection of the "interbranch complex" concept in an area of intensive development. Based upon collective research, the concept, "West Siberian Oil and Gas Complex," entered scientific circulation, its functional and regional bounds were specified, and its internal ties and specialization in the national economy were planned.<sup>2</sup> Although this research continues and an unambiguous definition of all the most important characteristics of the oil and gas complex remains to be achieved, it has become possible, from the methods standpoint, to rely on the notion that the West Siberian Oil and Gas Complex is a regionally restricted interbranch system on the national-economy level which has at this stage a clearly expressed DEGREE OF PRIORITY OF ITS PRODUCTION AND ECONOMIC GOALS: solution of the fuel and power problem, which is most important for the state. At the same time it was clear a priori, and while developing the area it was confirmed, that social and economic factors determine, in the final analysis, the path of achievement of these national-economic purposes. This influence is mediated by labor productivity and the quality and quantity of the labor resources used, that is, the assignment of personnel to production facilities, the stability of the labor collectives, the level of labor discipline, the effectiveness of personnel relocation, and so on.

Socio-economic relations are marked basically by a predominance of regional and horizontal ties, an interbranch complex--an aggregation of industrial enterprises and contracting organizations and their ties with respect to the control of production and only partly--by the social results of the production process. The problem of coordinating the branch and regional approaches for controlling social development is universal for social production, and it emerges especially distinctly in the oil and gas complex of West Siberia as a result of the scale and dynamicity of its development.

The branch structures for controlling production and economic activity were set forth at the birth of the oil and gas complex. "Realization of the program for creating an oil base in West Siberia occurred within the framework of branch control and covered the Ninth and 10th Five-Year Plans in time. However, this was only the first step...." Simultaneously, this program was the greatest interbranch problem, which was effectively solvable theoretically only in the framework of a relatively closed system--of a regional production complex or other similar structure, in which alone balanced development of the productive forces of the zone being conquered could be achieved.

However, the reality is more complicated than the theoretical notions. First, branch control adapts itself by necessity to new natural, economic and geographical conditions, which are manifested distinctly and precisely in West

Siberia, since branches of the oil and gas complex have redeployed the center of their activity to the region, which is specific as to the aggregate of natural and economic factors. And the branch system was compelled to consider regional peculiarities of economic activity and the life-support requirements in the content itself of the decisions adopted.

Second, creation of the country's largest fuel and power base is not only an interbranch problem but also an interregional one. In terms of its significance the West Siberian Oil and Gas Complex can be related to top regional programs that are aimed at solving the most important of problems and which determine key directions for deploying productive forces and improving interregional economic proportions.

At the same time, the notion itself of a program for forming the West Siberian Oil and Gas Complex as being an extraordinary, if only because of its duration, action of the state (the formulation of this attribute of the TPK [regional production complex] is M. K. Bandaman's),<sup>5</sup> which necessarily is associated with the concentration of productive forces in space and time--such a notion does require study, both of the branch principle in its regional aspect and of regional socio-economic problems in their interregional manifestation as an objective characteristic of said complex, taking into consideration the fact that, in the course of time, THE RELATIONSHIP OF THESE PRINCIPLES and the area of optimization of their interaction will be changed.

Control of a regional economy is based upon the principles of integration in the development of productive forces where there is specialization of the territory within the national-economy system. The purpose of planning the development of administrative and economic regions is "the planned, controllable combining of specialized, auxiliary and servicing type operating facilities, based upon making more complete and effective use of local resources, with rational ties among economic regions and the country's economy as a whole."<sup>6</sup>

Specific-purpose regional production complexes that are created for solving key national economic tasks should also provide for proportionality of social production within their borders. Proportionality and balance are among the most important attributes of a special-purpose TPK: it is a "deliberately created, proportionally developed aggregate of stably interrelated facilities of branches of the national economy and of labor and natural resources...concentrated in a limited area...."<sup>6</sup>

Meanwhile, execution of a large-scale program begins with the destruction of the existing horizontal proportionality and balance that takes shape by introducing new specialized branches in the territory, where previously they were absent or had not been developed adequately. The integrating branches and the infrastructure had not been developed correspondingly. The rapid extensive development of specialized branches can intensify the disproportions of the initial stage and weaken the internal and strengthen the vertical ties of the territory. We are in actuality observing these very processes.

Instead, a state of balance is achieved in the national economy in regard to resources, the intensive development of which served as the impulse for

developing the territory, and proportionality of the structural components of the unified national economic complex is developed on that basis. The principle of planned development is thus realized, through vertical branch control and at a level higher than territorial.

At the same time, this means that an investment program that is effective in terms of final economic benefit takes shape from actions that are extraordinary and, sometimes, not in accord with all the parameters of actions that have been coordinated with each other, and some of these extraordinary actions can be inadequately effective according to local (cost-accounting and branch) criteria. The internal ties of the regional economy lag behind the rate of growth of the elements that comprise it, and thereby the systems-function properties are weakened, the attribute of emergentness is not fully realized, and, finally, the optimal functioning and full discovery of the productive and economic potential of the elements themselves are hampered. Apparently, the leading economic contradiction in forming a special-purpose TPK lies in this: a reduction of the local effectiveness of the production structures that comprise the complex because of a weakening of their intra-systems communications that results from extensive-type development, and, simultaneously, the prerequisite of achieving a national-economic benefit as quickly as possible. Since it is possible to establish the conversion of a quantity (the extensive development of productive forces) into a quality (the forming of an intensive economy of a different level in the territory)--this contradiction can, in our opinion, be characterized as an objectively inherent economic discontinuity.

Thus, the development and the forming of a specific-purpose program can be represented as a process whose beginning and ending (more precisely, forecast) phases are characterized by balanced development of the region's productive forces, but the transition zone between these phases disturbs internal balance and proportionality when development is greatly accelerated through large-scale investment and enlistment of the productive forces of other parts of the country. It is generally recognized that the planning horizon for specific-purpose programs at the national economy level cannot be less than 20-25 years; on the time axis this period corresponds to the transition zone. A more recent circumstance raises interest in a study of it: the conversion of a region's productive forces into the new status of a specific-purpose program TPK at the national economy level, which is jumplike in economic content, can be called short-term only on the historical scale, since it occupies a time interval of several five-year plans.

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The conceptual mechanism and the degree of elaboration of mathematical-economics models will enable forecasts and long-term plans for the development of a TPK to be carried out fully, its boundaries to be designated, the complex of enterprises of specialized branches and the infrastructure that make up the complex to be coordinated regionally and the pace and sequence of achievement of the program's final goals to be optimized? Development according to plan is thereby introduced at the design and planning stages. No less urgent is research of the characteristics of the process, the path to achievement of the goal, and the evolution of socio-economic conditions within



a framework that is not ideal but is THE ACTUAL economic mechanism and order for adopting decisions.

In order to clarify the difference of the proposed approach from the traditional one, let us examine the latter's scheme. Under the traditional approach, a region's productive forces and natural resources are studied. A model of TPK development is worked out, and its results are in some degree or another included in the plan. Retrospective-analysis methods study the dynamics of developing productive forces as the actual process deviates from the ideal one depicted in the model, deviations from the designed path (which is close to optimum) being viewed with adequate justification as state losses. This path protects against planning errors and proves out proposals for revising the economic development of the new territories. Causes of deviation are treated within the framework of this approach as subjective errors, the consequence of inadequate scientific preparation of plan solutions, violations of planning discipline, and so on, which correspond with the truth to a great extent, but remain outside the bounds of the theory of analyses of causes of the rather large-scale emergence of the indicated deviations. Apparently, use of the results of economic calculations of this type is necessary (on their basis alone is it possible to limit the object in time and space and to establish a goal), but it is still inadequate, since this approach does not permit the objective principles of socio-economic relations to be found in the dynamics.

It is desirable to examine certain characteristics of controlling the production and social development of a region being developed. First, the material realities of the development process and, especially, deviations from the substantiated path of development were occasioned, in our opinion, by the divergence of the objective principles of the trending of the territorial systems from the objective properties of the country's unified economic mechanism.<sup>6</sup> The unified economic mechanism should possess, and it does possess, a greater time-lag factor than a local system, however important the latter may be for the state. Second, optimization of the path of a regionally specific program is possible only within the framework of the existing economic mechanism and on the basis of a consideration of the tendencies for improving it. Those innovations that correspond, on the one hand, to the collectives' interests and to the conditions of the specific territory, and, on the other, can be used in other similar economic systems, can be viable. Achievement of the state-set plan, primarily the production plan, the goal, serves as a criterion of the correctness of the revision.

The social and economic development of the territory has as its goal the habitability and settlement of the territory and the establishment of all the best conditions for man's expanded reproduction, and, therefore, it cannot be restricted by the final goal in terms of time, but should be forecast only in the broadest historical and ethnological terms. The development of a regional production complex, on the contrary, has a final, previously established goal, a planning horizon of 20-25 years, and it can be considered completed upon the development or exhaustion of the natural resource upon which the forming of the new production facility was based. This is because the purposes of social development of a territory cannot be identical to the basically production tasks of developing the region's productive forces. This is

manifested more distinctly at an early step in the development of a regional production system--the stage of branch (or interbranch) complex--in the processes of recruiting labor resources and creating a social infrastructure.

The enterprises in the region being developed need stable personnel; here, to a still greater degree than would be the case elsewhere, the importance of labor resources with good-quality characteristics grows: the qualifications, readiness for working under difficult conditions, and the presence of a definite set of socio-psychological traits that are adequate for the complicated conditions. These parameters are extremely difficult to sustain over a long period of production development, which entails the recruitment of large populations from outside and make migration and the shuttle movement of labor resources objectively desirable. All this--as a result of the stochastic nature of migration and adaptation of the population to the new natural and social conditions, which is slow because most of the regions being conquered are located in relatively less favorable geographical areas--introduces an element of instability into the situation, complicates production development and entails definite socio-economic outlays if the tendency is not counteracted. Also operating are other factors that are characteristic for pioneering stages of the socio-economic development, namely, objective restrictions on living conditions and on the possibilities for satisfying the life-support requirements in terms of the basic elements because of the lack of development of the social infrastructure.

It is known that a lag in the social infrastructure has characterized virtually all the known fairly large investment programs for conquering the natural resources of new regions. It is also known that the thesis of the high effectiveness of the anticipatory development of the infrastructure of regional production programs that was advanced decades ago by the initiators of Soviet regional economics still has not been refuted by anyone. Obviously, a principle must be found for such a departure of divergence of theory and practice, so that, within the framework of the existing economic mechanism, a path will be identified for solving this contradiction.

We hypothesize that a leading factor in this situation is that production necessity is the impulse for the rapid and highly extensive development of a territory. In this case, the state, as a rule, when examining long-term plan periods, has several alternatives and projects that compete with each other.<sup>2</sup> That is why, before the state begins to execute large-scale capital investments, their high effectiveness should be confirmed realistically and, thereby, a priority be set for the given program. The economic result of the program in this case becomes the source of financing for its development. Such a prerequisite explains much in the development of West Siberia's oil and gas regions, where the construction of cities and settlements adopted the necessary framework only after this area had become one of the country's large oil and gas recovery regions.

Another cause of lag of the social infrastructure is, in our opinion, the differences in specific aims when planning production and social development.

The creation and development of a program that is based upon natural resources in an area not previously developed (and the program for the West Siberian oil

and gas complex is just such a one) is motivated by the high effectiveness of the recovery and production of leading natural resources that exceed the average for the country's indicators or by the necessity for making up for an absence (or shortage) of such resources. In either case, the program is oriented from the start to a maximum of production, the pace and deadlines for achieving which are limited by the economic possibilities or by natural geographic factors. Social policy, on the contrary, is based upon the principle of averaging out the living conditions as to branch and region. The necessary differentiation of social conditions and the local (for the branch, for northern regions, for high-mountain regions, and so on) increment in the totality of allocated material benefits that is required should be justified by specific climate and geographic location of enterprises, demographic considerations, and economic and other priorities. The governing impulse for intensifying social development is, for one or several reasons, the consequence of the overall lag in living conditions behind the average achieved throughout the country (with a correction for local conditions) for a substantial share of the participants of the regional specific-purpose program. It is known that the requirements for living standards (comfort of housing, recreational conditions, cultural conditions, shopping support and so on) are, by their nature, poorly susceptible to formalization, are based upon an analysis of large-scale phenomena, are manifested in the economy through such indicators, which are, in a high degree, synthetic, as the social productivity of labor, intensity of migration, labor turnover, and the quality of labor resources, and can be registered only as the indicators pointed out change. This means, first, that decisions for boosting investment in the social sphere are adopted primarily on the basis of heuristic processes, and, second that they lag behind the planning and control of production.

The practical consequence is that the infrastructure of new regions begins to be developed only after the production facilities are put into use, and construction-industry capacity simultaneously becomes overloaded when peak loads in the construction of production facilities and of housing and nonindustrial facilities coincide, and, therefore, the infrastructure lags behind basic production, reducing the program's economic effectiveness.

The lag in the social infrastructure definitely is linked with the fact that the specifics of developing the North and other remote regions affect the economic indicators of housing and nonindustrial construction in its modern forms more sensitively. As is known, increased labor and freight-hauling costs primarily are inherent to the economics of development, which influence above all labor-intensive types of work and the processes connected with moving heavy elements that cannot be broken down. The erection of permanent housing and public buildings undoubtedly combines the indicated attributes. Therefore, housing and nonindustrial construction, after lagging when forming of the program started, is not able in many cases to work up the required pace.

Apparently, the scope of the SYSTEMS CONCEPT of an aggregation of methods for solving socio-economic contradictions is substantiated methodologically. Such an aggregation should possess the following characteristics: encompass and be oriented toward solution of the leading social and economic problems; consider in the greatest degree the specific situation for the area's production and

social development; correspond basically to the existing economic mechanism, while the innovations that are necessary for adaptation to regional conditions could be realistically executed within time periods commensurate with the dynamics of the region's production development; and, finally, be directed to satisfying the social demands of the workers and answer to the high requirements of modernity.

We consider that such a systems concept, in supporting the tasks of scientific analysis, should in no small degree operate also for practical needs, and, for this purpose, have the functions of a "sign," a symbol: be semantically unambiguous and sufficiently simple and encompassing for inclusion in the actual processes of adopting decisions in the area of planning, design and improvement of the economic mechanism and other aspects of controlling the processes of mastering the territory. In proceeding from the indicated principles, the concept of the "rotating-duty expeditionary system" was also introduced into scientific circulation.<sup>10</sup>

The rotating-duty expeditionary system embraces the production, economic and social aspects of economic activity in the territories being developed, based upon the use of the labor resources and social infrastructure of the country's inhabited regions. We have singled out in this concept two interrelated and mutually dependent components: the concept of the social and economic development of a territory, based upon the rotating-duty expeditionary system, and the rotating-duty expeditionary method of production activity in various branches of the national economy, including construction.

It is desirable to examine the concept of the socio-economic development of a territory under the rotating-duty expeditionary scheme under limiting conditions. First, this is a territory that encompasses a specific-purpose TPK. Second, changes are introduced into the common procedure for regional planning, design and control, primarily in the socio-economic aspect. In essence, we are referring to changes in shaping the region's social development that are caused by the rapid rate of production growth (branch and, to a great extent, extensive), the complicated natural and economic-geographic conditions, and the high intensiveness of the demographic (basically migrational) processes that are a function thereof. The zone's regional classification for labor activity and for permanent-residence communities for the city-forming portion of the population, the emergence of group systems for settlement, and the accompanying change in the taxonomic structure of the communities should be considered in urban-planning layout and design. Special layout solutions are required for support- and base-type communities, rotating-worker settlements, field cities and other mobile settlements, and other facilities of the social infrastructure. Methods for regulating unorganized migrations also must be developed.

The rotating-duty expeditionary method of production activity is viewed as a special form of production activity in industry, geology and construction, during exploration and the erection and operation of dispersed facilities and (or) complexes (a field or a construction project) in areas of development, which calls for the work to be done by the forces of mobile subunits, with regular departure of shift-type collectives for a facility being operated or erected that is remote from the organization's place of deployment, and it



includes: methods for organizing labor activity, based upon a summarized accounting for worktime and for special modes of work and time off; forms for creating and operating a mobile social infrastructure; and the organizational structures and the peculiarities of managing mobile construction and pioneering activity in the industry.

The rotating-duty expeditionary system is aimed at resolving the contradictions between: a) the production-economics orientation of the complex and the social purpose in developing the territory; b) branch control of production and regional control of the social infrastructure; c) the short periods of functioning of the fields and the long-term existence of cities and of industrial enterprises with ineffectiveness of substituting production facilities; d) the long-term goals for settlement of the region and the zonal restrictions on the period of residence by the arriving population; and e) the requirement for permanent-party qualified personnel and the necessary migrations, and the shuttle movements of labor resources. In the construction of the oil and gas complex this is the contradiction between the mobility of the operations and of the laboring collectives and the three-dimensional fixity of the facilities, which is intensified because of growing specialization, which is occasioned by the specifics of the construction branch and by the seasonality of the work and the scattered state (or linearity) of most construction projects.

The rotating-duty expeditionary system as a whole is aimed at solving problems and contradictions of urban development, the procedure for recruiting and using labor resources, and other aspects of social development that are common for a rapidly developing region. This provides a basis for treating the systems concept as the key one for analyzing the specifics of the socio-economic relations of a national-economic complex of the specific-purpose program type.

Thus, the principle of a more complete consideration of the actual economic mechanism of regional economics lies at the base of the concept of the social development of a specific-purpose program TPK. Flexibility and the forming of reserves are leading features of the proposed changes. Flexibility is provided during long-range planning of the social infrastructure by the designing of a control for regional layout and a scheme for settlement as cities that are structures that are being developed deliberately and are being supplemented by a transformable system of settlements for industrial zones and of ties between them. In the sphere of labor relationships, in the regulation of migrations, the necessary flexibility and, simultaneously, the creation of a reserve, can be provided by the organized formulation of mobile organizations and the rotating-duty expeditionary method of performing the work. All this is aimed as a whole at the stable systematic development of production, creation of the prerequisites for forming TPK's, and compensation for the stochastic influences of social, economic and natural factors.

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The social and economic aspects of developing the country's urgent program--the West Siberian Oil and Gas Complex--lie at the intersection of most important problems: the development of an investment subsystem and the social development of the region, which reflect in the greatest measure the specifics for developing new territories and therefore can be evaluated as a large and priority object of scientific research.

based upon an analysis of trends in developing the West Siberian Oil and Gas Complex, basic principles for the socio-economic development of regions and for change of social and labor relationships in pioneering branches of industry and in construction can be established.

Control of an entire regional economy that becomes complicated can occur only within the framework of the country's unified economic mechanism, and, the more successful it is, the more precise and valid will its basic characteristics and properties be considered when adapting control methods to local conditions. For this purpose, the objective parameters and methods for controlling production and social development of a region must be studied. Aside from its practical purposefulness, such research provides, in our opinion, definite possibilities also for developing economic theory and for granting it a testing ground at which a large-scale leap in the productive forces occurs where there is stable growth of the economy.

The hypothesis that the West Siberian Oil and Gas Complex should be viewed as a model by which the underlying postulates of regional economics and, apparently, certain general laws of socialism's economic can be verified is fruitful.

#### FOOTNOTES

1. VOPROSY EKONOMIKI [Questions of Economics], No 10, 1978, pp 19-27.
2. Sibir' v yednom narodnokhozyaystvennom komplekse [Siberia in the Unified National Economic Complex]. Novosibirsk, 1980, pp 248-268; and Metody i praktika opredeleniya effektivnosti kapital'nykh vlozheniy i novoy tekhniki [Methods and Practice for Determining the Effectiveness of Capital Investment and of New Equipment], Moscow, No 29, 1978, pp 77-87.
3. Sibir' v yednom narodnokhozyaystvennom komplekse..., p 248.
4. Bandman, M. K. Territorial'no-proizvodstvennyye komplekсы: teoriya i praktika predplanovykh issledovaniy [Regional Production Complexes: the Theory and Practice of Preplanning Research]. Novosibirsk, 1980.
5. Metodicheskiye ukazaniya k razrabotke planov ekonomicheskogo i sotsial'nogo razvitiya avtonomnykh respublik, krayev, oblastey i otrasley respublikanskogo (RSFSR) podchineniya [Methods Instructions for Developing Plans for the Economic and Social Development of Autonomous Republics, Krays and Oblasts, and Industries of Republic (RSFSR) Subordination]. Moscow, 1978.
6. Sibir' v yednom narodnokhozyaystvennom komplekse..., p 235.
7. See: Investitsionnyye problemy narodnokhozyaystvennykh kompleksov [Investment Problems of National Economic Complexes]/Edited by V. P. Krasovskiy. Moscow, 1975; Bandman, M. K. Territorial'no-proizvodstvennyye komplekсы...; and Regional'noye programnoye planirovaniye. Voprosy teorii i praktiki [Regional Program Planning. Questions of Theory and Practice]/Edited by R. N. Sniper. Novosibirsk, 1981; and others.

8. We confine ourselves to L. I. Abalkin's data for defining the concept, "economic mechanism." (See Khozyaystvennyy mekhanizm razvitiye sotsialisticheskogo obshchestva [The Economic Mechanism for Developing Socialist Society]. Moscow, 1973, pp 10, 34-35.)
9. According to the definition of Academician N. P. Fedorenko (1971)--"competitiveness of purpose." Also see: VOPROSY EKONOMIKI, No 8, 1978, pp 30-33.
10. See the substantiation for this concept in the author's articles in journals: PLANOVVOYE KHOZYAYSTVO [The Planning Activity], No 9, 1977, pp 88-95; and VOPROSY EKONOMIKI, No 8, 1979, pp 47-55, and No 8, 1981, pp 35-45; and also in the book, Khaytun, A. D. Ekspeditsionno-vakhtovoye stroitel'stvo v Zapadnoy Sibiri [Rotating Duty Expeditionary Construction in West Siberia], Leningrad, 1982. That work examines changes in the control of socio-economic development of TPK's which result if the principles of this method are adopted as a basis.

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## GENERAL

### LOW CONSTRUCTION-BASE CAPACITY SLOWS PROGRESS AT URENGOY

Novosibirsk IZVESTIYA SIBIRSKOGO OTDENELIYA AKADEMII NAUK SSSR: SERIYA OB-SHCHESTVENNYKH NAUK in Russian No 3, Sep 83 pp 49-53

[Article by V. I. Skorobogatova (Novosibirsk State University imeni Leninskiy Komsomol): "An Analysis of Development of the Urengoy Industrial Cluster (Capital Construction)"]

[Text] The Urengoy Gas-Condensate Field, where it is planned that the main growth in natural-gas recovery will be obtained, has a decisive role in the creation of the country's gas-recovery base during the 11th Five-Year Plan. A five-fold increase in recovery above that obtained during the 10th Five-Year Plan must be achieved at the field. It is planned to begin development of the oil fringe of the field and to promote the recovery of gas condensate on a scale that will exceed the 1980 level 10-fold.

The organization in Novyy Urengoy of a huge center for natural-gas recovery required the introduction of new capacity at the fields and substantial development of the production, social and domestic-services infrastructure. An industrial cluster is being formed in the poorly developed Far North under extreme natural conditions, which require nonstandard approaches to the problem of adapting the people, equipment and methods for construction and production operations.<sup>1</sup>

It is preferable to form such a specific-purpose industrial cluster within the framework of a unified program that will unite the actions of the branches that are taking part in development. An analysis of the progress of the Urengoy Industrial Cluster during its first years of development indicated that isolation and lack of balance in participants' actions leads to the emergence of disproportions and threatens fulfillment of the specific-purpose tasks.

Overcoming the lag in construction behind the investment program's requirements is the key problem of Novyy Urengoy. The industrial cluster's capital investment plan is not always being met. Thus, capital investment was 71.8-percent assimilated in 1979, 74.7 percent in 1980 and 70 percent in 1981.

<sup>1</sup>Nikonenko, I. S. and Orlov, B. P. "Questions of Establishing a New Gas Recovery Base." IZV. SO AN SSSR [Herald of the Siberian Department, USSR Academy of Sciences], 1981, No 11, SER. OBSHCHESTV NAUK [Social Science Series], No 3, pp 123-126.



Introductions of fixed capital into operation were, respectively, 54, 45 and 50 percent of the plan. The undeveloped state of construction capacity on the one hand, and the low level of the materials base for construction on the other, were the causes of this lag.

The pioneering step in the forming of a regional economy for the industrial cluster coincided with a strengthening of the buildup in gas recovery. For 4 years it exceeded the designed level of the Medvezhye field. The high rate of extraction of natural-gas resources indicates that the gas industry had entered the intensive development stage. The construction base by this time was in the initial stage of forming its in-house capacity. The readiness of the production base for construction for building up facilities for the first-priority sector of the field was 30 percent of the designed level.

The construction base's lag caused the capacity of the infrastructure branches to be 70 percent of the requirements thereof in 1981. The length of roads within and between oilfields was one-third that called for, and this was aggravated by the lag in permanent-type main highway connections with industrial regions.

Capital construction by the end of the 10th Five-Year Plan was provided with 80-60 percent of the planned requirements for material resources. The local building-materials industry's lag was not compensated for by importations from the inhabited parts of the country because of the low throughput of the transportation network, and also because of great losses during transport, reshipment and storage of materials. Up to 20 percent of the materials and equipment arrives in an unsuitable condition because of the lack of well equipped storage bases.

The low reliability of the electric-power system has restrained the pace of the drilling over of the field. The nonfulfillment of drilling plans for 1978-1980 by 10-15 percent testifies to this. Delay in introducing an LEP-500 [500-kV power line] from the Surgut GRES and the lack of a permanent-type network of power lines within the industrial cluster have led to the use of low-powered independent power plants, which require much greater labor and materials costs.

Another serious problem is establishment of the social and domestic-services infrastructure. The rate of population growth in 1978-1980 exceeded considerably state-housing and domestic-services construction. This caused a sharp lag in the level of providing the population with housing, public-health facilities and preschoolers' institutions behind the average indicators for the RSFSR.

Thus, at the pioneering stage of development of the Urengoy Industrial Cluster, the gas industry came up right away to the intensive level of developing resources, but the associated branches had only started to form. Such an imbalance in development threatened fulfillment of the assigned tasks.

The high specific tasks set for the Urengoy Industrial Cluster require the creation here within a short time of facilities for servicing basic production.

questions of providing dynamically for the balanced development of all branches of the economy of the industrial cluster will acquire special urgency because of this.

One of the main prerequisites to harmonious development and to planning for it with precision is determination of the requirements for output and services of the branches which are associated with gas recovery at the intermediate stages of development. Within the framework of the branch's planning, the reverse task--making an integrated evaluation of the branch's adopted strategies from the standpoint of their influence on the results of the specific-purpose program for creating the industrial cluster, particularly the deadlines for recovering the planned amounts of gas--is urgent. Timely identification of the group of branches that sustains formation of the industrial cluster and the levels of shortfalls in their capacity will enable development of a system of measures for providing for balance in current plans and for fulfilling successfully the specific-purpose tasks.

As a tool for solving these tasks, we used a simulated critical-path model for forming the industrial cluster, making branch studies that were tentatively united in the framework of the program for creating the Urengoy Industrial Cluster the basis for it. The critical-path model will enable the sequence of carrying out the program to be reflected in time, taking the participants' interrelations into account, the requirements for services of the interdependent branches to be clarified, and effectiveness of the process of realizing the program to be assessed. In changing the topology of the critical-path, the time spent carrying out the operations, the prescribed deadlines for creating capacity for production and for the social and domestic-services infrastructure, and the characteristics of the inputs employed in the operations, it is possible, by means of the critical-path model, to vary the strategy for forming the industrial cluster.

Thus, use of the critical-path model, which simulates the process of creating the Urengoy Industrial Cluster, will make it possible: a) to evaluate the effectiveness of the strategy adopted for promoting the program, in time, from the standpoint of achieving the specific-purpose tasks of the industrial cluster; b) to determine the state of balance of the development of its branches and the influence on the deadlines for the prescribed tasks; c) to evaluate the adaptability of the process of forming the industrial cluster to possible changes of external conditions: in the volume of financing of capital construction, of support with labor resources through migration, of shipments of material resources, and of throughput of the interrayon transportation grid.

Capital construction for the gas industry, power engineering, the road network within the region, and the social and domestic-services infrastructure were represented clearly in the critical-path model for forming the Urengoy Industrial Cluster during the 11th Five-Year Plan. Construction, the building-materials industry and external rail and water transportation appear with input restrictions. Their development is represented in the form of growth of capacity with time. In so doing, a multitude of strategies for building up capacity by year of the plan period is examined. For each of them we seek a

calendar plan for forming the industrial cluster.<sup>2</sup> Based upon an analysis of the received aggregation of calendar plans, the effect of the strategy for developing the indicated branches on the specific tasks for recovering gas, on the periods for carrying out the program as a whole, and on the program's economic effectiveness is evaluated. We find the best strategies for forming the construction base, for shipping external material resources, for developing the interregional transport network, and for creating the social and domestic-services infrastructure in accordance with evaluations of the period for realizing the program and of the program's economic effectiveness. Thus are formulated the basic requirements of the program for creating the industrial cluster for purposes of developing the branch, within and without the industrial cluster, from the standpoint of its national economic purpose.

One of the basic causes of the lag in the infrastructure branch is the low potential of the construction base. The influence of the level of its development on the capital construction program can be assessed by introducing into the critical-path model as an input the amount of construction and installing operations performed at the industrial cluster, which will be examined as a synthetic indicator that characterizes the construction base's capacity. Another limiting input is capital investment. Each operation of the critical-path schedule is marked by a requirement for these inputs.

Solution of the task of calendar planning where resources are not restricted showed that the investment program can be carried out by the deadline. The computed dynamics of the construction-base capacity that is obtained testifies to a substantial growth of it in the first 3 years of the five-year plan:

Rate of growth of cost of construction and installing work	1981	1982	1983	1984	1985
Computed.....	2.33	1.74	1.19	0.97	0.78
Planned.....	1.92	1.12	1.07	1.2	1.2

The necessity for such vigorous growth of capacity is intensified by the circumstance that there is practically no time log for building up. The largest growth occurred during the first year of the 11th Five-Year Plan.

An analysis of the projections for developing Novyy Urengoy construction organizations indicated that their overall capacity will be lower than computed.

<sup>2</sup>Calculations were made for a set of programs that was developed in the Mathematics Institute of SO AN SSSR [Siberian Department, USSR Academy of Sciences]. The basis of it is an algorithm for optimization of a multiple-input critical path model which is realized both for storable and nonstorable resources, taking the prescribed dates into account. Optimization is accomplished gradually in accordance with the criterion of a minimum of time for completing the design and a minimum of overall deviations of the dynamics of the hypothetical resources from the prescribed restrictions. See: Gimagi, E. Kh., Puzynin, N. M. and Sevost'yanov, S. V. "Certain Extremal Tasks in Realizing Large Projects of the BAM [Baykal-Amur Mainline] Type." *EKONOMIKA I MATEMATICHESKIYE METODY*, 1979, Vol 15, No 5, pp 1017-1020.

Consequently, they will not be able to provide for program fulfillment by the deadline. We can evaluate the effect of such construction-base dynamics on progress in realizing the investment program, taking it in the critical-path model as constraints on input. The calendar plan indicated that under these circumstances all program operations can be fulfilled only in 7.8 years, that is, there is a delay of 2.8 years in comparison with the prescribed task.

During the first 5 years the gas industry realized only about half the capital investment program. The other half is being mastered at a doubled-up pace in the ensuing period (2.8 years). At the same time, the main portion of the investment was in electric power. Highway construction is being carried out mainly in 1984-1986. Two years later the highways will start to operate. The intolerability of such a schedule follows from the program's specific tasks.

Making the deadlines for realizing the program more rigid will require additional construction-base capacity. This is apparent from the results of calculations for variants, where the periods for fulfilling the design are reduced iteratively and brought close to the prescribed dates.

Below is shown the growth (in percents) of the construction-base capacity by variant in comparison with the planned dynamics of construction and installing work:

Variant	Prescribed periods for carrying out the program (years)	1981	1982	1983	1984	1985	1986	1987	1988
1	5	21	89	111	71	13			
2	5.5	-	23	62	88	48	47		
3	6	-	5	-	64	57	113		
4	7	-	-	-	-	-	115	39	
5	7.8	-	-	-	-	-	117	69	38

In order to carry out the program by the prescribed deadlines, a greater increase in buildup of the construction base's output is required. It must be doubled in comparison with the plan practically by 1983. The amount thereof is equivalent to the capacity of a whole main construction administration. Of the variants examined, the most acceptable is the second, since, with the time for realizing the program increased by half a year, there is a reserve of time in the initial period, while in later years the rate of growth in requirements for construction-base output is not so great.

Growth in construction-base capacity can be speeded up by wider introduction of the outfitted-module construction method and the use of new equipment and technology. Introduction of new technologies in the gas industry will enable the requirement for construction and installing work to be reduced. The methodology we used will enable the benefit of such measures in carrying out the program to form the Urengoy Industrial Cluster to be evaluated quantitatively.

The lack of time reserves for overcoming the existing lag requires a search for basically new solutions. One of those possible is organization of the



"construction assault": the use of the rotating-duty expeditionary method of construction with a support base in the industrially developed regions of the Urals and the south of Tyumen Oblast. However, in so doing, a flow-line type of organization for delivering building materials by interregional transport is necessary.

In order to determine the requirement for building materials for the industrial complex and the degree of satisfying it at each plan-period interval, we take the weight of the arcs in the critical-path model as equal to the materials intensiveness of the operations. Thus, each operation requires inputs--building materials in the amount necessary for erection of this object or of a phase. We list the requirements for resources in estimated 1 million rubles' worth of construction and installing work according to USSR Gosstroy norms, differentiated by branch and by characteristic large objects of the industry, first reducing it to a unified weight indicator.

As a result of the solution, we obtain the requirement for the importation of building materials dynamically by year of the plan period for realizing the capital construction program by the prescribed deadlines. They can serve as a task in determining the strategy for developing the transport network.

Fulfillment of the capital construction program depends greatly upon the presence of labor resources. We calculate the requirement for them for each operation of the critical-path schedule, based upon the amount and type of construction and installing operations and the output per worker employed in construction. The output per worker for a critical-path schedule depends upon the composition of the construction organizations that are participating in its fulfillment and their share in the forthcoming construction volume. The calendar plan indicated that the first years of the five-year plan are marked by a high rate of growth of construction cadres. Based upon the requirement for construction personnel and their share in the city's total manpower population, we determine the estimated dynamics of the population that is occasioned by the investment program's requirements. It indicates that by the end of 1983 the size of the population contemplated in the city's master plan for the end of the five-year plan will be reached.

The basic factor that restrains the flow of labor resources is the housing inventory. If one proceeds from the hypothesis of planned regulation of migrational flow of the population and the introduction of housing called for by the social program for developing the city, then it can be confirmed that the city is in a position to accept a population that numbers below the level of the investment program's requirements by an average of 20 percent for the whole period.

In taking this computed manpower as a rigid limitation on the amount of usable labor resources, we assess its influence on the period for realizing the program. Calculations indicate that the capital construction program for the Urengoy Industry Cluster can be fulfilled with said labor restriction in practically 6 years.

In order to accomplish the whole investment program during the five-year plan period, we try to speed up the introduction of housing space, fulfilling the

program for the social development of the city in 4 years. In this connection, construction manpower should have grown back at the start of the plan period. We introduce this manpower into the model as a limiting input. Changes are also required in the topology that concerns the urban development program.

The schedule we obtained indicated that outstripping construction of facilities for the social and domestic-services infrastructure could provide for scheduled fulfillment of the prescribed tasks for gas recovery.

Another possibility for eliminating the imbalance that has arisen is to increase the rate of growth of labor productivity in construction, which would reduce the requirement for labor resources. This, in turn, would lead to a reduction in the rate of growth of the population being recruited and the required amounts of nonproduction construction. It is a self-evident fact that labor is less of a constraining resource than the construction base. The shortage of construction-base capacity stretches out realization of the program by 2.8 years, the shortage of labor resources by 1 year. Thus, the analysis of the forming of the Urengoy Industrial Cluster that was conducted on the critical-path model indicated that the branch's decisions do not completely eliminate disproportions between construction-base capacity and the scale of the investment program that existed back at the pioneering stage, and between the requirement for labor resources as to time and the dynamics of the introduction of facilities for the social and domestic-services infrastructure. The delay in the deadlines for fulfilling the program that has been caused can be eliminated only by means of wide recruitment of construction capacity from other parts of the country.

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